February 1963

culture

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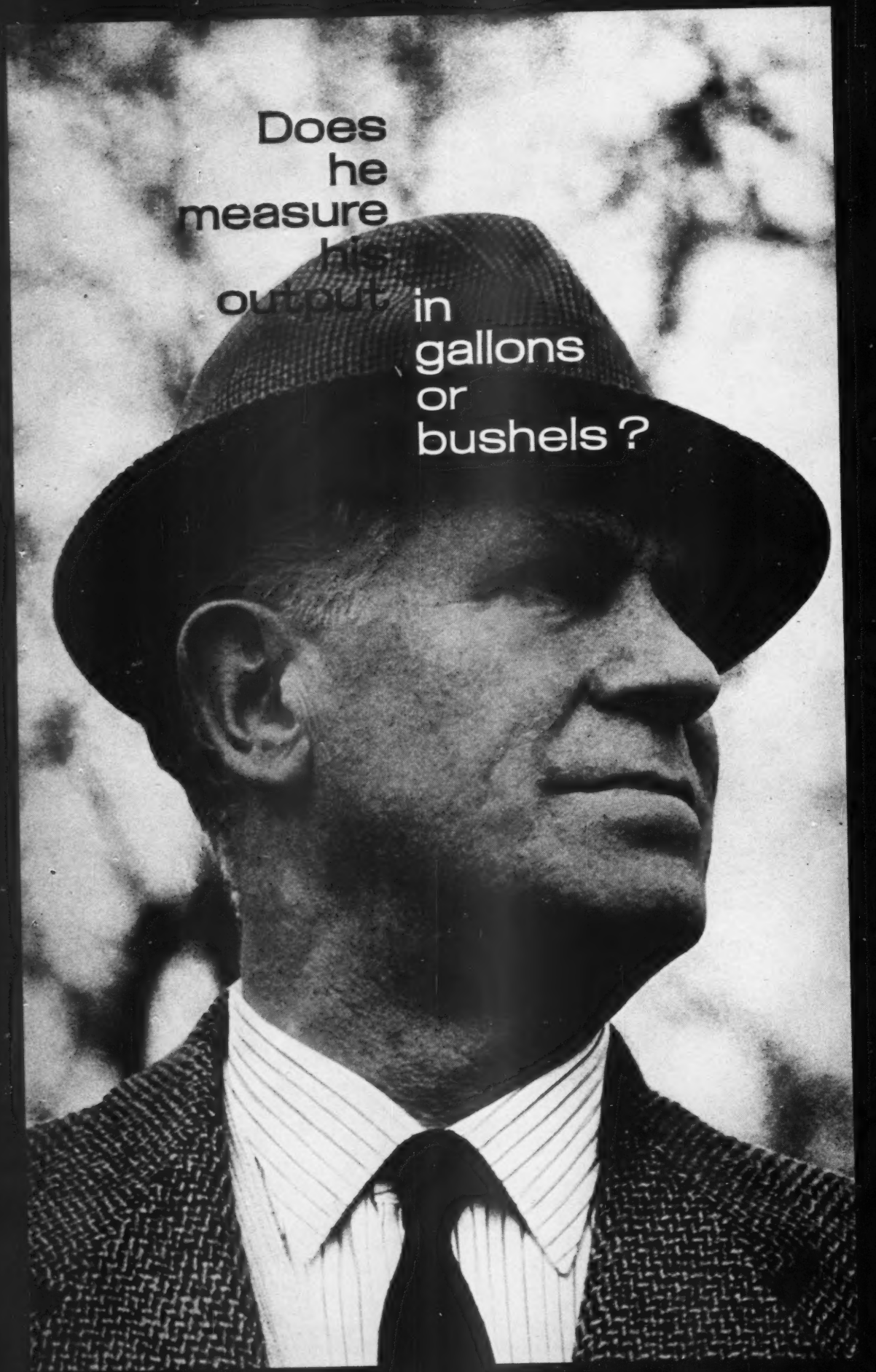
Published for the Ministry of Agriculture, Fisheries and Food by Her Majesty's Stationery Office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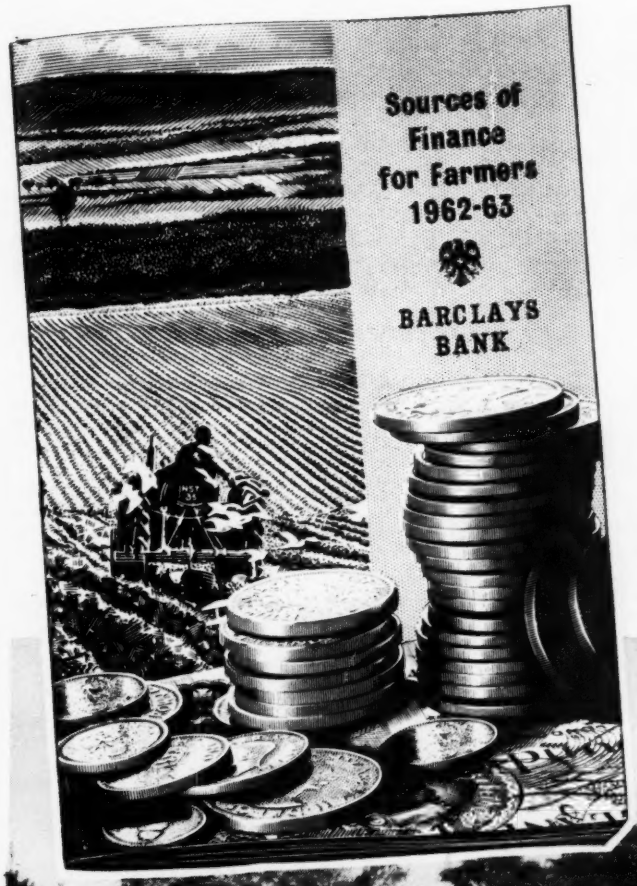

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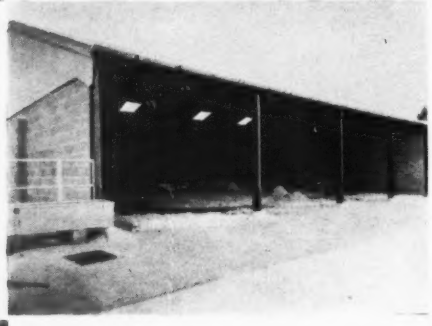

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Agriculture

VOLUME 70 · NUMBER 2 · FEBRUARY 1963

Editorial Offices
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Less from the Bag

BOUGHT concentrates are costing the dairy farmer a shilling per gallon of milk produced, and the bill for imported stock feed runs the nation into nearly £200 million every year. Neither can really afford this expenditure under present circumstances, and a New Year resolution to graze more and feed less from the bag, if kept, would benefit both farmer and nation.

The amount of concentrates and cereals fed per gallon of milk produced on the British farm greatly exceeds anything dreamt of by Kellner, the nineteenth-century nutritionist, and while part of this is due to inevitable wastage (and perhaps some careless handling), much is undoubtedly caused by persistent over-feeding of dairy cows, especially at times when they already have an abundance of good quality grass. Too much is being fed to get the last few gallons from the herd, and yet, with all this lavish feeding, the production of milk nationally still depends on grass and goes up or down as grass growth rises or falls.

There are plenty of examples to show that milk from grazing is profitable to the farmer, and while the standard of management of a Rex Paterson or a Stanley Morrey may be beyond most of us, a more confident reliance on grass in the feeding programme of the dairy cow could reduce costs substantially without a marked loss of quantity or quality in milk.

W. Emrys Jones
Director of the National Agricultural Advisory Service, looks at

THE YEARS AHEAD

DURING the next twelve months the initials N.P.Y. (National Productivity Year) will become very familiar, not only to farmers, but to everyone connected with the processes of production in this country. There can be no doubt that the key to the future prosperity of Britain lies in the word 'productivity' and the concept that lies behind it.

The increasing prosperity of agriculture which has marked the last twenty years has been achieved by increasing production. We are now producing 82 per cent more from our farms than we were before 1939. And the figure is still going up. The crucial question to be faced now is: 'Will higher production in the future automatically mean greater profit?'

Farming costs have risen steadily in recent years and to counteract them there has been a widespread tendency to produce more and more. This has been possible by increasing yields of crops and stock and by reinforcing farming systems by adding processing enterprises, such as pigs and poultry. Indeed the results of research, particularly in the biological sciences, are 'output-expanding' by their very nature when put into practice on the farm.

All this is excellent, as far as it goes. But recent events in the markets make it all too obvious that expansion of output, as a means of counteracting rising costs, can succeed only so long as there is a profitable outlet for the commodities concerned. When production exceeds consumption requirements, the inevitable result sooner or later is a fall in prices. Take the case of milk.

New thinking on milk

Dairy farming is going through an unprecedented period of adjustment and development which is leading to a high degree of flexibility and improved capacity to absorb new ideas and new methods.

Great progress has been made in the production and conservation of high quality grass. Fertilizer usage has increased substantially, leading to a higher output of milk per acre and lower costs per gallon. Loose housing and self-feed silage have furnished an entirely new approach to the management of the dairy herd. Many cowsheds erected in the early 1950s are already out-of-date and need considerable modification if they are to accommodate the new methods and techniques that have been evolved since then.

Modern parlour designs and well-organized milking routines have substantially reduced the physical effort required to handle increased numbers of cows. Already the sixty-cow herd is regarded by some progressive dairy farmers as a one-man unit.

Although the number of milk producers is falling at the rate of 4,000 a year (in England and Wales), the national herd has been expanding, and the average yield per cow is rising—by over 200 gallons per cow in the last twenty years. All this, of course, means that milk production is rising—and at an average rate of about 100 million gallons a year during the last three years.

Certainly the consumption of milk and cream is rising, but not nearly fast enough to keep pace with the expansion in milk production. The result is that the pool price is still falling and the profit per gallon has decreased steadily for the past 8 or 10 years. Eight years ago the profit on an average gallon of milk was 11*d.*—today it is less than 7*d.*

Increased yields—but at what cost?

Farmers often forget, or are unaware of, what the increased yields cost them. Let me give you one example known to the N.A.A.S. A farmer was producing 238 gallons a day at summer peak. His grass was good, but he fed additional concentrates to his cows at the rate of 3½ lb per gallon sold. He was advised to stop feeding cake and to rely completely on his grass. Daily production fell by 30 gallons, but the saving on bought feed was 832 lb a day. So these extra gallons had been costing him 6*s.* 10*d.* each to produce. This farmer is now operating a system which produces less milk but at a much lower cost per gallon and at a substantially higher profit margin.

Purchased and home-grown feed, apart from grazing, represents half the cost of milk production. So any saving in these is bound to have a direct bearing on the level of profit per gallon. There is immense scope for the better exploitation of our grassland.

Recently we have seen the results of a two-year study of a group of dairy farms carried out by the Grassland Research Institute in the south-east of England. The results have a national significance. Now the average output of all grassland on the twenty-five farms in this study was 19·5 cwt of utilized starch equivalent per acre. Our 20 million acres of permanent grass and leys in the United Kingdom produce just over 14 million tons of utilized starch equivalent for animal feed per year. This is equivalent to 14 cwt of starch equivalent per acre. If this level of production were raised to the level achieved on the recorded farm, it would amount to an extra 5½ million tons of utilized starch equivalent per year from grass.

There is plenty of scientific evidence that a carefully planned switch to efficient grassland utilization can mean the same or higher farm profit from a lower volume of milk produced. This is the lesson for dairy farmers everywhere. Our competitors across the Channel—in Holland and Denmark—know well enough the potential of feed value of grass and are exploiting it

to the full. In many parts of Britain we can grow grass in abundance. We have the right climate, we have a wealth of 'know-how', and if we press on with improved utilization, we are taking the sure way to improved profitability and greater competitiveness.

Plans for sheep

No less are there important and significant developments in sheep farming which we must recognize now if we are to make sound plans for the future.

The sheep flock is expanding both here and in New Zealand. Market prices have been low in recent years and there is a substantial amount of Exchequer support in the British sheep farmers' returns. The consumption of lamb in the United Kingdom is much higher than in any other country in Europe, but there is likely to be an increasing demand in the future for standard, graded lambs, probably in much larger lots, with forward contracts for specific weights and grades.

New systems of sheep husbandry are emerging which will enable farmers to specialize to a far greater extent than in the past. Already there are some sheep farmers achieving gross outputs of between £50 and £60 per acre. This is better than most dairy farmers can do with milk. It is now possible to envisage one man being responsible for 1,500–2,000 ewes, producing twice as many lambs. This is no pipe dream, for with the vastly improved methods of disease control and sheep handling arrangements, it comes well within the capacity of a one-man unit.

Prospects for beef

Prospects for beef production should be good in view of the rising standard of living. Intensive beef and barley-fed beef will develop only as long as cereal prices are £25 per ton or less. It is reasonable, I feel, to expect great developments on the breeding side. There should be more recording on commercial farms, and performance and progeny testing can be promoted on a national scale. Marketing demands will require a standardized carcass and consistent supplies.

Marketing is all-important

Great strides have been made during the past twenty years in improving farming methods and raising output per acre and per animal. In the last two or three years we have been hearing more and more about reducing the 'unit costs' of production. What really are the factors which influence the farmer's revenue? I suggest that they fall into three groups: (*a*) technical efficiency, (*b*) management and organization, and (*c*) marketing.

The first two have received much attention and need little comment, although there is still plenty of scope for improvement in management. It is marketing that is likely to demand the greatest adjustment in farming systems and methods in the years ahead.

In some commodities such as milk most of the marketing function is taken care of and need not be the concern of the individual farmer. The record of the Milk Marketing Board speaks for itself. But there are a number of important commodities such as store cattle and sheep, fat lamb, beef, etc., where there is plenty of scope to explore possibilities of developing new marketing methods.

In general, the problem will be to find the best methods of coping with the demands of fewer and larger organizations concerned with distributing and retailing these commodities. Personally, I believe that the farming industry will be expected to solve many of its own marketing problems and that this can only be done by group methods.

Quite a number of farmers have an annual turnover of not more than £4,000. In the modern world of big business this is not likely to command a great deal of respect by any standards. But if fifty such farmers act together, they command an annual turnover of £200,000. This is big business. In these circumstances modern business methods can be adopted, contracts can be secured and premiums attracted. Production programmes can be planned well ahead and new market opportunities can be exploited.

Into gear

British agriculture is on the threshold of a new phase in its development. We shall see many changes in farming methods and new systems of production. Increased mechanization will demand more capital, but it will raise the productivity of labour. We can expect dramatic changes in market demands and the ways in which farmers do business. The challenge will be great, but through higher productivity the industry can be geared to meet it.

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Additions to this list will be announced in *Agriculture* as they are made.

THIS IS THE SIGN TO LOOK FOR

G. F. C. WHEELER WRITES ABOUT THE ISLE OF WIGHT SYSTEM OF

Soilless Composts in Old Glasshouses

THE early tomato crop is still the bread-and-butter business of small glasshouse growers, but unfortunately it is the one crop which is most susceptible to soil-borne pests and diseases. Houses which bear heavy crops of high quality fruit when first erected on fresh land, become progressively less profitable as soil diseases and pests build up; rooting also becomes less extensive and healthy.

The Isle of Wight has a high proportion of the older type of houses. They lack steam sterilization equipment and the soils, physically played-out, are often infested with virus diseases and root pests and further deteriorated by poor drainage. Some four years ago it was almost impossible to grow reasonably economic crops on many of these holdings.

These problems were difficult to overcome. The age and condition of some of these houses, coupled with the uncertain economic conditions of the industry and the difficulty and cost of raising new capital, prohibited the installation of new steaming equipment. Re-soiling was not a satisfactory alternative, because of the high costs of labour and transport and the difficulties of obtaining suitable loam locally. Some cheaper and more easily adopted alternative system of growing had therefore to be found.

Mr. E. Newman (right) manager of Mr. David King's Mereton Nursery, I.O.W., discusses his crop with the author

Sand and peat compost

For many years past the staff of the N.A.A.S. in the Island have been investigating the possibilities of growing commercial glasshouse crops in loamless composts. Preliminary work by Mr. C. P. Barrett of the N.A.A.S. showed that excellent tomatoes and other glasshouse crops could be grown in compost composed entirely of local washed sand with a proportion of peat and added inorganic fertilizers, provided the plants were fed from the outset with a balanced liquid fertilizer containing the necessary trace elements. Work at the University of California added to our information on the use of these loamless composts (mainly with reference to growing pot plants in containers) and stimulated our interest in soilless composts as a commercial proposition in the United Kingdom. Obviously, what was needed in the Isle of Wight was a method whereby tomatoes and other crops could be grown in these composts without involving too much labour and capital expenditure —a method which could be applied easily to the smaller and older type of house on the small nursery, where steaming, re-soiling, and often chemical sterilization, were not practicable.

Trying it out

The present system was evolved as a result of experiments which I carried out on several Island nurseries with the co-operation of keen growers. The first nursery to adopt this system was Mr. C. L. Devoy's Priory Nursery at Seaview. Here, a high water-table prohibited adequate steaming, and the physical structure of the soil had deteriorated to a point where it was no longer suitable for tomato growing. The floors of three houses, each 100 ft × 30 ft were concreted down, and concrete-sided beds about 6 in. deep were constructed, six to each house. The plants were grown in 9 in. cardboard pots, standing on 4–5 inches of soilless compost; trickle irrigation was used to give continuous liquid feeding.

Results more than justified the introduction of the method, but the capital cost was too high to allow the system to be adopted generally. Attention was then turned to the possibilities of insulating the existing infected base soil of other houses by covering it with 150-gauge black polythene sheet and putting down the peat and sand base over this. This produced excellent results and a high increase in yield on several Island nurseries. A compost composed of three parts sand to one part peat by bulk, with a base fertilizer incorporated, was placed over the whole area which had been sheeted down, and 9 in. cardboard pots were stood down at orthodox spacings on this base.

Two-row beds

During the last two years some growers have been making up two-row beds the length of the house, with 4 in. × ¾ in. rough sawn boards and covering the paths between them with clean gravel over polythene. This makes handling the crop easier and is considered generally more hygienic than covering the whole floor of the house and using boards as pathways.

Another, and cheaper, satisfactory method of soilless growing consists of having deeper beds (of about 8 in.) again with board sides, filled with the same compost and planting direct into the bed instead of using cardboard sink pots.

A sample of clean, coarse sand and peat, as used in soilless compost

Trickle irrigation works as well with this method as with pots. Experimental beds with sub-irrigation depending on capillary rise, and filled with sand without the addition of peat, have proved less satisfactory. It seems that even a small proportion of peat gives better results; the peat appears to have a buffering effect which is lacking in pure sand composts.

The success of this system depends entirely on maintaining absolute hygiene. The old base soil must be completely insulated from the new compost and care taken not to contaminate the new beds with soil from other sources in any way. The gravel paths over polythene prevent soil from being trodden on to the new beds on workers' boots. Care must be taken not to introduce infected soil on boots, pots or implements.

Sowing and potting

Plants are propagated in the usual way, but using a University of California sowing medium, i.e.,

U.C. Soil Mix D

25 per cent fine sand, 75 per cent peat moss incorporating
4 oz potassium nitrate
4 oz potassium sulphate
2 lb single superphosphate
5 lb dolomite lime
4 lb calcium carbonate lime—all per cu. yard

The plants are then potted off into 3-4 in. cardboard or other pots in the University of California composts.

U.C. Soil Mix B

75 per cent fine sand, 25 per cent peat moss
6 oz potassium nitrate
4 oz potassium sulphate
2½ lb single superphosphate
4½ lb dolomite lime
1¼ lb calcium carbonate lime
1¼ lb gypsum—all per cu. yard

Both of the U.C. mixes contain moderate amounts of available nitrogen, but supplementary feeding of the plants is required within a short time.

The larger pots prevent the plants becoming pot-bound too early if planting is delayed while removing a preceding crop. Many growers favour keeping the plants in these larger pots for a longer period before planting, especially with very early crops. Careful attention is paid to propagating temperatures in the light of recent recommendations from the N.A.A.S. Horticultural Experimental Stations. The final growing-on compost for both beds and 9 in. cardboard pots is as described above.

The particle size of the sand used does not appear to be too critical but it should be clean, free from clay and organic matter. Most good quality moss or sedge peats have been found suitable, but a top quality moss peat is preferable.

Liquid feeding

Liquid feeding is important, because the base fertilizers, while providing sufficient nitrogen phosphates, lime and magnesium for the plants to start well, will not maintain growth for a long period. Feeding is started as soon as the seedlings are potted off into 3–4 in. pots, and then continues throughout the growing life of the plants until the bulk of the crop is harvested.

The liquid feeds generally used in the Isle of Wight in conjunction with these composts are those recommended by the N.A.A.S. and set out below:

	Analysis of nutrients (lb per 10 gal)			
Type of feed	N	P_2O_5	K_2O	*Composition of stock solution*
High potash (Basic solution)	2·0	0	6·3	1½ lb potassium nitrate per gal
Main potash	3·3	0	6·3	Basic solution plus 5 oz urea or 6 oz ammonium nitrate per gal
High nitrogen	6·3	0	6·3	Basic solution plus 16 oz urea or 20 oz ammonium nitrate per gal

These are fed continuously at dilutions varying from 1–150 to 1–200 according to the behaviour of the crops.

Tomatoes growing in sollless compost. Note the trickle irrigation system and gravel path

Necessary trace elements are added and it is found convenient to make up a concentrated solution to the following formula in one quart of water:

Boron	1 oz
Ferrous sulphate	2 oz
Manganese sulphate	¾ oz
Sodium molybdate	¾ oz
Water	2 pints

Three fluid oz of the solution is added to every gallon of the concentrated feeds, giving a final dilution of 1½ fl. oz per 75–100 gallons of dilute feed.

System for older houses

This new method of growing tomatoes has now been under commercial trial in the Isle of Wight for several years, and it has proved extremely satisfactory on many holdings. Crops of 80–90 tons per acre have been grown from early sowings where the plants have been cropped until late summer. The quality and flavour have been excellent. It has also almost completely fulfilled its original purpose of controlling soil-borne pests and diseases. Botrytis and Cladosporium have also been much reduced.

It is not suggested that the system is preferable to orthodox methods of growing in new houses or in houses of up-to-date design with adequate steaming facilities. But it is a system which can well be adopted on any nursery with older houses, particularly where the physical condition of the the natural soil has deteriorated and diseases and pests prevent the production of a healthy root system, and where virus is a major problem.

The costs of laying down the new beds are quite reasonable. In fact, costs are less over a four-year period than the orthodox system where soil has to be steamed every other year. It is clean, easy to handle and economizes in labour. Many other successional crops can be grown successfully in these composts, including lettuce, chrysanthemums, freesias and roses.

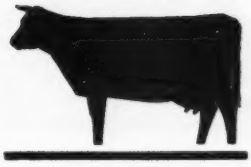
In the Isle of Wight, beds which have now produced three crops of tomatoes and two flower crops still appear to be relatively free from serious diseases —particularly from virus—and it is probable that they will go on for another two to three years before the composts have to be changed. The relatively small quantity of compost used, as compared with re-soiling beds, will facilitate the change of the compost when the time arrives and, in any case, the old compost can then be stacked outside, sterilized and used again after several years, or used directly for improving outside land.

This system of growing glasshouse crops allows less room for error than where orthodox principles are observed, but it can be adopted safely by any careful grower and can go a long way towards solving the difficulties of growing profitable glasshouse crops in houses where this has proved impossible in the past.

G. F. C. Wheeler, N.D.H., is in the National Agricultural Advisory Service. He is County Horticultural Advisory Officer in the Isle of Wight, where he has been experimenting during the past four years with a wide variety of glasshouse crops grown on a commercial scale in soilless composts.

WHAT KIND OF DAIRY COWS SHALL WE WANT IN THE FUTURE?

This was one of the important considerations discussed at the Harrogate Livestock Breeding Conference last November



HARROGATE

Considering Milk

W. Longrigg

Now that a dairy bull can sire some thousands of calves in the national herd, it is of vital importance that the technique of sire selection should be constantly under review. Even in the days when the use of a bull was confined to natural service, the selection of a future herd sire called for endless deliberations by the would-be constructive breeder.

With the more scientific approach and the much wider use of records, tabulated and sorted by computor, the paper side of bull selection has been eased considerably. Conformation, with all its attributes, must still be assessed by visual inspection. This latter point, because of the widely differing opinions held, is certain to provide a most interesting topic for discussion at any conference on breeding. Thus Dr. Alan Robertson, speaking at the Harrogate conference, defined modern selection as 'choice made on information'.

Is it then to be wondered at that differences of opinion arise when production alone covers yield, fat, solids-not-fat and, perhaps in the near future, speed of milking and the efficiency to convert foodstuffs into milk. To this production list must be added breed type, conformation, wearability and longevity.

Equally important is the need for a large section of the dairy cows of the country to be capable of producing calves suitable for the beef industry.

Newstead Zwartman, first proven sire in the progeny testing scheme sponsored by the A.R.C. at the Cambridge Cattle Breeding Centre

Long-term aims for breeding dairy cattle

The views of the dairy panel, which prepared the report for the Harrogate conference, were fairly well defined and objective in their suggestions for the long-term approach to cattle breeding.

In the panel's opinion a dairy cow should be capable of yielding milk of the right composition at an economic price. The cow herself should produce offspring at least as good as herself, and at regular intervals of not more than thirteen months. She must be healthy, docile and long living and be quick and easy to milk.

A large proportion of these cows should be animals of large capacity and high efficiency so that they can turn grass and its products into milk satisfactorily, besides possessing considerable beef potential.

A smaller proportion should be suited to graze and do well under more rigorous conditions of land and environment. Yet another section would contain cows capable of meeting the known consumer demand for milk of a high chemical quality.

Dr. H. P. Donald, Director of the Animal Breeding Research Organisation at Edinburgh, suggested that what was wanted were cows of a higher economic merit, capable of making the best use of improved environment and feeding. Can the potential genetic improvement best be achieved within or between breeds? If the answer is 'within the breed' then this is most likely to be done by progeny testing or the importation of animals sired by progeny-tested stock.

Progeny testing

An apparently immaculate back pedigree carries with it little guarantee of genetic merit. Though the geneticist may prefer to work with animals of known breeding, he can only hope to make positive progress through progeny testing. Examples of full brothers used in A.I. were quoted. One bull raised the production of his daughters by 77 gallons, whilst the other brought the yield down by 35 gallons.

The now widely accepted 'contemporary comparison' method of assessment is considered the most reliable when testing for yield. This method has the advantage over station testing in that many more daughters can be used in the comparison. Also many more progeny groups can be handled, and of course it is cheaper to operate. For fat content, the simple arithmetical

average of the daughters' fat percentage is used. It is understood that solids-not-fat figures calculated in the same way may well be available.

But this production data has to be considered jointly with information on conformation, wearability and udder formation, before the true worth of a bull can be estimated. Production and conformation ratings are of equal importance, and a truly proven bull will excel in both.

Even with this so-called relatively cheap system of testing, it is likely that a proven bull, emerging from a batch of five or six having the accepted pre-test qualifications, will cost the A.I. centre some £4–5,000.

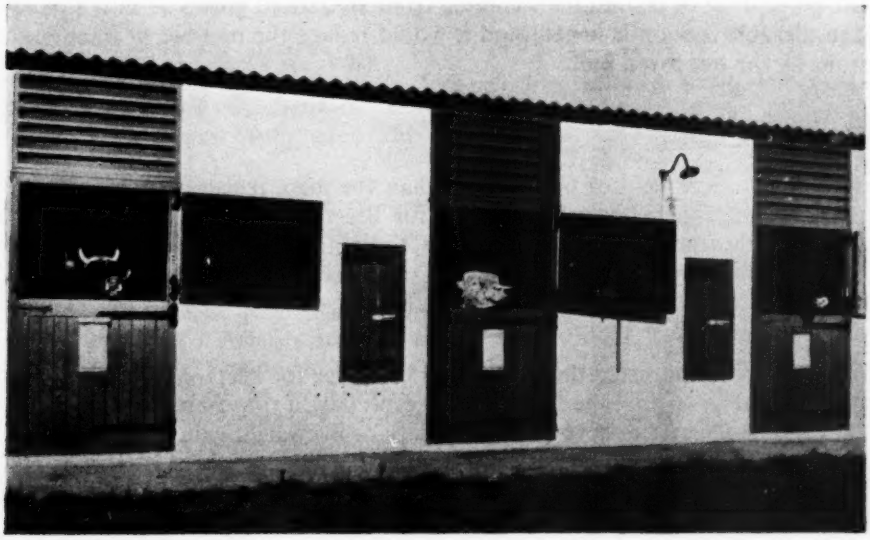
This assessment of dairy bulls by contemporary comparison can be done only with the continuing full co-operation of the owners of officially milk-recorded herds. It could well be true that when such herds are used exclusively for the testing of unproven bulls they will fail to keep pace with others using only semen from proven bulls. There is much sound sense in the system adopted by the Cambridge Cattle Breeders Ltd. where inseminations from the proven and the unproven bulls are used in equal proportions in all herds.

Station testing, where batches of heifers by a limited number of bulls are brought together for their first lactations, is expensive to operate and has a very limited throughput. On the other hand, it can be of considerable interest and help to breeders; it would be especially valuable where daughters of bulls which had shown real promise in the contemporary comparison test were collected together. For this purpose it would only be necessary to assemble the progeny groups for a short period; and comparatively few testing stations would be required throughout the country. Such a programme would have real educational and publicity value.

Private breeder

Most of the progress made in cattle breeding to date has been brought about by the skill, backed by judgment, of the individual breeder. There is no fear that breeding can, or should be, taken out of his hands.

Bull boxes at the Cambridge Cattle Breeding Centre, showing Jersey, Hereford and Red Poll sires



The present scientific approach, supported by factual information from the Central Sire Register of the M.M.B. and the Breed Societies, can hasten and ease the breeder's task. To keep a strong, vigorous livestock breeding programme, it is imperative that the private breeder should continue to pursue his own particular individualistic method, thereby preventing any narrow approach or excessive concentration on the fashions of the day. There is obviously something to be said for Mr. Meiklejohn's comment on why a breeder would rather breed his own stock bulls. 'I know a lot more about my own cows than I do about anyone else's', he said. The private breeder is in the strongest position to observe all the characteristics of his own stock, and even the much maligned daughter/dam comparison can have real merit if the information is properly assessed and correctly used.

The top of the pyramid of any breed is made up of a relatively small number of creative breeders. It is they who set the standards and produce the majority of the sires used by the herds lower down. The only thing lacking in these herds is mere numbers, and there are definite signs that this can be overcome by the grouping together of a number of breeders into a syndicate. They will use A.I. on a wide scale for testing young bulls and for the spreading and preserving of their best blood lines. These groups will undoubtedly be one of the spearheads of progress.

Buying young bulls for A.I.

An increasing number of young bulls will have to be tested in the future. The present methods of purchase are apparently causing considerable heartburning amongst breeders. They feel they should have a continuing monetary interest if a bull of their breeding should get into the 'top twenty'.

There is a sound case for a modest initial payment at purchase, being followed by further payments after the bull is proven. Young bull selection for testing must obviously be done on the soundest lines possible. Every effort should be made to see that only those bulls with the highest all round qualifications are put forward for testing. Should a way be found which increases the percentage of proven bulls coming from an untried group, it would be of considerable economic benefit and it would reduce the number of inseminations by the unproven bull.

Breed Societies

A much wider field of opportunity than the mere registration of animals and checking of pedigrees is foreseen for Breed Societies. Such matters as type classification, co-operation in the compiling of the Central Breeding Register, the furnishing of information on outstanding female lines and the reporting of harmful recessives could benefit equally their members and the national herd.

Dr. Donald suggested there may well be a case for keeping differing types of animals even within the same breed—especially if they were kept separate. How much regard ought to be given to size or liveweight gain when selecting dairy bulls of the larger breeds for A.I. now that the dairy herd is responsible for producing so large a proportion of cattle reared for beef in this country? Contributions from Breed Societies on such matters would be of real value.

Research

The future of dairy cattle must obviously be tied most closely to economic merit. Results from improved breeding are not nearly so striking as those which can be achieved by alterations in management or environment. Good progress can be made, however, even though it may be slow in the case of cattle.

Is improvement likely to come more quickly from organized cross-breeding or from trying to create it within the breed? The five to ten per cent betterment in fertility and viability up to first calving shown by cross-breds over their pure-bred mates can be of real material benefit to the milk producer. Research in this important field of heterosis must continue.

Blood grouping may have something to offer towards cattle improvement, but at the moment the balance of evidence is against this happening. Studies on the handling technique for deep-frozen semen will continue and undoubtedly in time it will be the equal of fresh semen.

The answer to the fundamental question of what makes one cow milk and another put on meat is so far a mystery. Will this problem ever be solved?

W. Longrigg, B.Sc., N.D.A., N.D.D., was brought up on a Cumberland farm. After gaining experience in advisory work in Warwickshire and Hampshire, he joined the N.A.A.S. in 1946 and for the last ten years he has been Regional Livestock Husbandry Officer for the East Midlands.

CONGRATULATIONS

to **Dr. Harold G. Sanders,** upon whom a Knighthood was conferred in the New Year's Honours List.

Dr. Sanders, who was born of farming stock at Wollaston, near Wellingborough, on 9th October, 1898, has been the Ministry's Chief Scientific Adviser (Agriculture) since 1st January, 1955.

He graduated at St. John's College, Cambridge, and was at the Animal Nutrition Institute, School of Agriculture, Cambridge, from 1922 to 1929. From 1929 to 1944 he was University Lecturer in Agriculture at the School of Agriculture, Cambridge, being seconded to the Hertfordshire War Agricultural Executive Committee as Executive Officer from 1941 to 1944. From 1944 to 1954 Dr. Sanders was Professor of Agriculture at Reading University.

EGGS

Plan for Profit

says **M. Whalley Taylor**

THE Golden Age for the egg producer is now passed. Since 1957, prices paid to producers for eggs have been falling and the costs of inputs rising. In June last year there were some 3 million (about 7 per cent) more birds over six months old on our farms than a year earlier. Egg production appears to be increasing by about 1½ per cent per bird a year and the throughput of packing stations was 12·4 per cent greater during April to September, 1962, than in the corresponding period in 1961.

In these circumstances many poultrymen are asking if they should stay in egg production, and if so what they can do to enhance their profits. Or, they ask, would their fixed equipment show a better return if modified to suit some other enterprise such as broiler or bacon production?

Knowing what it costs

The only producers who can attempt to answer these questions are those who know just what it costs them to produce eggs. It isn't a difficult job to find these costs, for one only needs to know the quantities and prices of the major goods and services which are used in producing eggs. The most important items in this respect are food, stock and labour.

Costings for a reasonably well-managed 1,000 bird laying flock might be:

Costs	£	*s.*	*d.*	*Returns*	£	*s.*	*d.*
Cost of pullets @ 14*s.* 6*d.*	725	0	0	Sale of eggs, 18,500 doz. @ 2*s.* 10*d.*	2,620	16	8
Cost of food, 44 tons @ £32	1,408	0	0	850 hens @ 5 lb @ 1*s.* per lb	212	10	0
Plant depreciation (cost of fixed equipment depreciated over 15 years)	133	0	0				
Labour (one-third of a man's time @ £600 per year	200	0	0				
Miscellaneous costs, e.g., vet. and fuel	100	0	0				
Profit	267	6	8				
	2,833	6	8		2,833	6	8

Though none of the systems described in this article covers exactly one year, it is convenient and reasonably accurate to regard them as being repeated at twelve-monthly intervals. One may therefore ask if this particular laying flock shows a worthwhile return on capital invested. The fixed capital is £2,000 invested in building and equipment and the working capital is £725 spent on pullets, plus say two months food bills £234, and one month's wages £17. This gives a total of £2,976, and a profit of £267 shows a 9 per cent return on capital. A profit of £267 on 1,000 birds is 5*s.* 4*d.* per bird, and the only way to find out if this represents a reasonable level of efficiency is to compare it with the results of other poultry-keepers. Furthermore, profit per bird is of little value when trying to decide if one should drop egg production and adopt a different enterprise.

Analysis by gross margin method

The *gross margin technique* is an alternative method of analysing the poultry enterprise. Though this technique is commonly applied to crops and land-using animals, it may also be used for poultry when the margin is more sensibly expressed either per bird or as a percentage of the output rather than on a per acre basis. In using this method, fixed costs are those items which are unlikely to change unless there is a radical reorganization of the farming system. Such costs remain the same whether hens lay well or badly or if mortality is high or low; depreciation of houses and fixed equipment, regular labour and rent come under this heading. The other costs involved vary with the production and health of the flock; they therefore include the cost of foodstuffs, the effect of mortality on flock size and miscellaneous costs such as vet. bills, medicines and fuel. If these variable costs are subtracted from the total receipts for all eggs sold, the difference is the gross margin.

In this case the variable costs are:

	£
Food	1,408
Flock depreciation	513
Miscellaneous costs	100
	2,021

If this total is subtracted from the price received for all eggs sold (£2,620), the difference (£599) is the gross margin. To make this meaningful, it is sensible to express gross margin as a percentage of output and to regard 25 per cent as the sort of figure one should attain. In this case the gross margin falls a little short at 23 per cent.

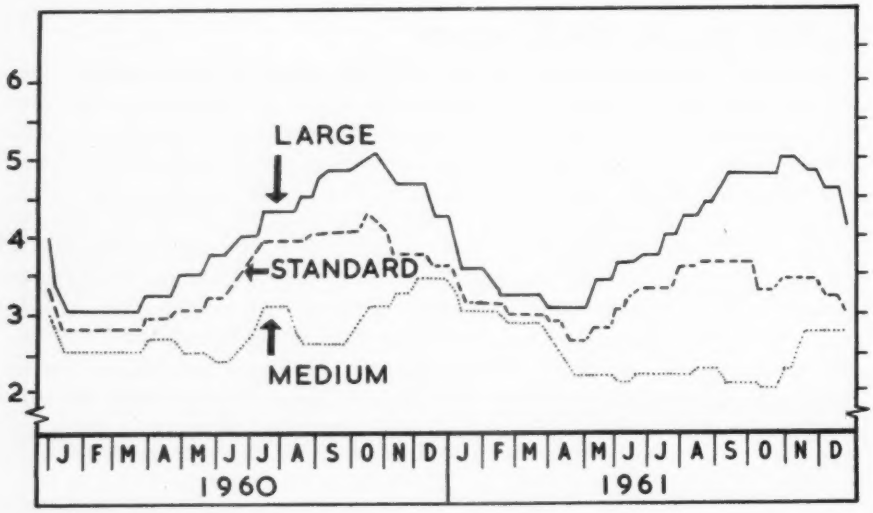
Both gross margins and returns on capital are useful measures of efficiency and by their very nature need not be compared with other farmers' results. A return on capital of 9 per cent or a gross margin at 23 per cent of output is unsatisfactory, and the poultry-keeper should try to find out what is wrong with his enterprise.

More birds

There are several ways of approaching the problem of increasing profits. One which has proved successful is to increase the density of stocking and so achieve a greater output per £1 of invested capital. In a case in point the

labour situation was such that if more layers were to be kept, point-of-lay pullets would have to be bought. Pullets were bought in late December and, as such, were a little cheaper because they were reared from 'out-of-season' days olds. Moreover they laid small eggs in January and February when the difference in prices between standards, specials and mediums was only 2*d.* to 3*d.* per dozen, but they were producing large eggs in quantity when the price differential was one shilling per dozen. On average the price received for all eggs sold was 2*d.* per dozen more than the price received for eggs produced from spring-hatched pullets.

Guaranteed minimum prices to producers by grades for hen eggs (Gt. Britain)
Shillings per dozen



In addition the pullets were reared on a decreasing light-pattern, but when they came into lay the natural daylight increased till it reached seventeen hours or so in late June. The lights were then turned on so that the birds enjoyed a 17-hour day till they were sold in early December.

In order to carry out these changes in management practices, certain additional expenses were involved such as insulating the roof of the battery house and installing forced-draught ventilation. This enabled the owner to put 3 pullets rather than 2 in a 15-inch cage. The results of these changes are shown in the following statement:

Costs	£	*s.*	*d.*	*Returns*	£	*s.*	*d.*
1,500 point-of-lay pullets @ 17*s.* 6*d.*	1,312	10	0	30,000 doz. eggs @ 3*s.*	4,500	0	0
Food, 60 tons @ £35	2,100	0	0	1,312 hens @ 4*s.* 6*d.*	295	4	0
Plant depreciation (£2,500 over 15 years)	166	0	0				
Labour	250	0	0				
Miscellaneous costs	110	0	0				
Profit	856	14	0				
	4,795	4	0		4,795	4	0

Using the same basis as in the previous example, the profit per bird was 11*s.* 5*d.*; the return on capital was 20 per cent and the gross margin 29 per cent of output.

This considerable increase in profitability has been achieved by using modern techniques and increasing fixed capital investment, coupled with relatively dear inputs such as expensive high energy foodstuffs.

Reduced inputs

Methods of raising output are not always either possible or desirable. For example, on a mixed farm an entirely different approach proved almost as successful. The object in this case was not to achieve maximum production of the right sizes of eggs at the appropriate seasons, but rather to reduce inputs by making the best use of existing facilities.

Day-old pullets were bought in April and reared on leys with a minimum of housing, and they were fed primarily on home-grown grain. As shown in the following table, the cost of rearing was low; indeed it worked out at 12*s.* 8*d.* per pullet, which included 10 per cent losses:

	£	*s.*	*d.*
1,100 day-old pullets @ 3*s.* 6*d.*	192	10	0
Food, 10½ tons @ £30	315	0	0
Labour	55	0	0
Plant depreciation	40	0	0
Fuel, drugs, etc.	27	10	0
	630	0	0

During the laying period the pullets were housed in an old barn on wire floors, and the cost of conversion was 15*s.* per bird. No charge was made for the building, for it was old and had served little useful purpose since the cows were sold.

Fully-controlled and automatic unit (water, light, feed) intended for 18-month's life-cycle, shown at early rearing stage

The financial results during the laying period were:

Costs	£	*s.*	*d.*	*Returns*	£	*s.*	*d.*
1,000 pullets	630	0	0	18,000 doz. eggs @ 2*s.* 10*d.*	2,550	0	0
Food, 44½ tons @ £31	1,379	10	0				
Plant depreciation	50	0	0	850 hens @ 5*s.*	212	10	0
Labour	150	0	0				
Miscellaneous costs	100	0	0				
Profit	453	0	0				
	2,762	10	0		2,762	10	0

The profit is therefore about 9*s.* per bird: the return on capital was 20 per cent which, of course, includes the rearing period, and the gross margin £653 or 26 per cent of output.

This short article stresses that productivity and not production is important and that there are several roads leading to higher profits. Simple farm management analysis will help to reveal weaknesses or to confirm the farmer's suspicions of where the faults lie. The flock-owner will then be in a better position to remedy them or to make up his mind to adopt alternative enterprises.

The author of this article, **M. Whalley Taylor, M.B.E., M.A.,** is at present Poultry Advisory Officer in the Yorks and Lancs Region of the N.A.A.S. He was formerly Agricultural and Food Attaché in Denmark and the Netherlands.

YORKSHIRE STORY
of easy calf rearing with little labour and low costs

THE RESULT: a relatively high net profit per head and a quick turnover of capital

G. D. PICK
N.A.A.S.

Baby Beef from Easy-Feed Silage

CHEAPLY produced baby beef (at about 15 months) from a diet consisting mainly of silage has been demonstrated by the N.A.A.S. in a three-year observational study on Mr. R. Marsh's farm at Knottingley, Yorks W.R.

Thirty-six suckler calves, out of Irish Angus × Shorthorn and Hereford × Shorthorn cows by a Hereford bull, were born during February and March, 1961, weaned in the October of that year and then yarded. There they gained an average of 2 lb and $1\frac{3}{4}$ lb live weight per day for steers and heifers respectively over a winter feeding period of about seven months.

All were on an 'easy-feed' system of silage feeding, material being cut twice daily and thrown behind a wooden barrier in front of the silage face. The forage-harvested silage was made from one-year leys, cut when the Italian ryegrass was in the young leafy stage; this crop came out at about 15 tons per acre. The ley received 4 cwt compound fertilizer in the early spring, followed by applications of 3 cwt Nitro-Chalk after each cut. Stacks were made within silo walls and sealed at the top. The fermentation was excellent and the silage, because of its high digestibility, readily eaten. The cows and yearlings fed at opposite ends of the silo. (Arable silage fed earlier proved to be too fibrous and the liveweight gains were lower.)

The rations and analyses of the silage fed to the yearlings last winter were (lb of food each day):

	Oct.	Dec.	Feb.	April
Silage (one-year ley)	30	40	50	60
Dry matter percentage	22·0	20·0	20·0	21
Crude protein percentage in D.M.	12·5	17·8	17·8	12·0
Hay	2	2	2	2
Oats	2	2	2	2
Barley	2	2	2	2

Good profit

The cost of the daily ration was roughly 1*s.* 10*d.* (silage £2 per ton, hay £10 per ton, cereals £22 per ton). The value of the 2 lb liveweight gain for the steers was about 3*s.* 3*d.*, leaving a margin over feed costs of 1*s.* 5*d.* per day. For the heifers, the corresponding margin was 1*s.* 1*d.* per day.

A single suckling herd was established because there is on Mr. Marsh's farm an area of very poor grazing—low lying, full of rushes and tussocks and waterlogged all winter. For this reason the calves were rather small at weaning. The cows calve in the covered yard in February–March, feeding mainly on silage and barley straw, and as soon as there is any grass the cows and calves go on to an adjoining home paddock next to the yard and from there to the rough grazing.

The total labour per day required for feeding the silage, hay and cereals to all the stock was about 50 minutes. Every week the yards were bedded and the silage face cleaned. During April and May, 1962, twenty-four of the cattle were marketed and all the carcasses made Special or Grade A. The condition of the calves was excellent but the twelve smallest were not quite heavy enough to qualify for the guarantee payment and so were turned out to grass until they reached the minimum weight.

Feed costs were (*pro rata*) about £15 per cow per year and £17 10*s.* per yearling for the full fattening period of seven months. The total return per beast was £70 and the margin over feed costs was approximately £37 10*s.*

Taking a quick look

Briefly, the results over three winter feeding periods were:

Baby beef animals were fattened on good silage with a little hay and cereals. No protein concentrates were used. The liveweight gains were $1\frac{3}{4}$ to 2 lb per

14–15 month old Aberdeen-Angus cross steers and heifers have access to silage in an open silo with a simple feed barrier

Suckling cows and Hereford cross calves run in a paddock adjoining the yard and other buildings

day. The suckling cows were winter-fed on silage and straw only, so showing very low annual overhead costs. The calves were not creep fed. Simple feed barriers in front of the silage face did not lead to any wastage. The yearlings had an above-average killing-out percentage and their carcass quality was excellent. Approximately 66 per cent received the beef subsidy out of the yards. The farm staff liked the system, since the feeding of the silage was relatively easy work. The labour saved in the winter was put to good use by carrying out maintenance work and other jobs.

GRASS

> Grass still has a greater potential for increased productivity at a lower cost than any other crop we grow.
>
> Lord St. Oswald, *Parl. Secretary Ministry of Agriculture.*

THE British Grassland Convention meets at Chesford Grange, Kenilworth, Warwickshire, on 26th March.

Details and brochure are obtainable from The British Grassland Convention, 109 Kingsway, London, W.C.2.

HORTICULTURE

BRAMLEYS

THEIR FUTURE MANAGEMENT

Eric Herwin

AN Australian friend returning 'down under' after a study tour of fruit production areas in this country, told his growers: 'In England the fruit is not marketed in accordance with specific grading regulations, hence there is a wide variation in quality and presentation. One of the problems hampering the introduction of grading regulations is the large area of farm orchards where apples are being grown under very poor conditions, with practically no attempt at disease or pest control or proper grading and packing.' Certainly these remarks apply to a lot of our dessert and culinary apples, but it is good to know that England's original Bramley (the variety was introduced into commerce almost a hundred years ago) continues hale and hearty and is likely to remain productive for a good many years to come.

Cooking apples are a peculiarity of the British, and the demand for them in the United Kingdom is in most years largely met by home production. Bramley's Seedling accounts for approximately 60 per cent of the culinary apple acreage, and the proportion continues to rise in favour of Bramley as other varieties are more heavily grubbed. There is evidence, however, that

the market for Bramley apples is declining. With rising incomes, people are demanding more exotic foods. The acreage of cooking apples has also shrunk in recent years, but with improved production techniques the volume of fruit harvested, though near its peak, continues to increase.

Where's the profit?

The profitability of the Bramley in this country has been suspect for a decade or more, and we are unlikely to witness better returns to the growers until such time as the existing acreage of elderly and unthrifty trees has been ruthlessly reduced. What is required is a positive grubbing programme—a planned policy of clearing uneconomic trees as a routine rotational act of good husbandry.

Some of our culinary apples are grown on unsatisfactory soils, a large proportion run an excessive risk of frost, and far too many trees have passed the age when they can be relied upon to produce good yields of large apples every year.

Many growers appear satisfied with a net price home of 15*s*. (even less) per bushel, but such returns are unlikely to be profitable unless yields of high-grade fruit exceed 500 bushels per acre. Another factor which influences the profitability of the Bramley is the size of the production unit. Many top-fruit growing enterprises are too small. Assuming an average yield of 500 bushels per acre and a net price home of 15*s*. per bushel, a producer needs 13 acres of Bramley's Seedling in full bearing to give him an income of £1,000 on the year's work. However, an average yield of 500 bushels per acre is rarely achieved—300 is nearer the mark. We know from the many financial and physical records examined that the cost to the producer of manures, sprays, cultivations, pruning and overheads is the same, whether the crop is 300 or 500 bushels, and the grower with a 300 bushel average will need 70 acres or more of mature Bramleys to show £1,000 profit at the end of his financial year.

Broadly speaking, an increase in the size of many small acreage fruit production units would lead to greater efficiency in the use of labour, machinery and services such as fruit storage.

The layman may be excused his surprise at learning that the Bramley apple continues to be planted by specialist producers. These growers believe that the future lies in the production of heavy crops of good, green fruit of 3 inches diameter and over, grown on a 35–40 year rotation. Future plantings by growers without access to gas storage are unlikely to prove economic.

Planting and planning

No one rootstock has found universal favour. On good, deep soils M.IX has been used by several growers in recent years. M.II and the newer rootstocks M.XXV and MM.111 are others favoured. The spacing and density of planting vary widely, being closely related to soil depth and quality, degree of exposure and the particular rootstock. Rectangular planting has been more common of late. Before trees in the hedgerow grow into one another they are sometimes thinned to leave a square plant. More thought is being given to plant arrangement.

The orchards must be planned to facilitate fruit handling. Many growers run into difficulty when handling pallets and bulk bins in orchards planned

before bulk bins for apples were thought of. It may well be that if the trend for smaller, precocious, more densely planted trees continues, existing handling methods will need further revision. Provision may have to be made in the planting plan for clearways every four to six tree rows or so, to facilitate the movement of apples in bulk at harvest-time. Such clearways would need careful siting, to reduce the risk of wind funnelling. The time must surely come—well before the end of this century—when 75 per cent, or more, of our apples can be picked from the ground.

And what of pollination? Good pollination is essential for regular cropping, but the ideal pollinator for Bramleys has yet to be found. Early Victoria, (syn. Emmeth Early), Lord Derby, Worcester Pearmain, Grenadier and, more recently, Howgate Wonder are being used. Of these, Grenadier is probably the most reliable. The Kent grower is usually able to market his Grenadiers ten days or so in advance of his less fortunate competitors farther north. A one-in-nine arrangement of pollinator in the main variety is the usual custom.

Pruning has been revolutionized in the past few years. The traditional regulated system has been applied more rigorously and modified to include spur simplification, and the cutting back or removal of old fruiting laterals. More attention has been given to nutrition—heavier dressing of nitrogen, both to foliage and to the soil—and a greater understanding of the need for a balanced potash-magnesium ratio. The standard of sward management these days is pretty good. Grassing down with seeds mixtures is exceptional. A natural sward is usually permitted to develop four or five years from the date of planting, and the risk of drying out and nitrogen deficiency resulting from a competitive grass crop is thereby reduced to a minimum.

The results of the grassing down of orchards trials in S.E. England suggest that whatever the seeds mixture sown, within six or seven years the predominant grass species is *Agrostis stolonifera*. Laying down a known sward has the effect of delaying colonization by indigenous grasses.

The occasional rotavation of old orchard swards in spring to a depth of not more than two inches, often has a tonic effect. It encourages the growth of productive wood.

Crop protection

The chemical control of weeds at the base of fruit trees is fast becoming standard practice. The removal of such weeds by hand is wasteful of manpower, whilst cutting by machine is rarely satisfactory. However, some soils under fruit trees react unfavourably to completely weed-free conditions, because excessive surface compaction occurs and leads to localized impeded drainage and attendant risks of asphyxiating the tree roots.

The economic control of diseases and pests is one of the most important factors in orchard management. The spray programme in mature Bramley plantations may vary little from year to year, and progressive growers budget for an annual expenditure of £20 per acre. Orchards which have not yet come into production do not always receive the spray programme necessary to produce healthy trees. Crop protection measures, to ensure freedom from diseases and pests during the formative period of the plantation, is a wise insurance.

Harvesting—from tree to grader

The wastage and depreciation of good marketable apples due to unskilled picking is a loss no grower can afford. Care should be taken when harvesting to ensure that the apple is picked with the palm of the hand and fingers, to avoid pressure bruising and abrasions by nails. It should then be placed, not dropped, into the fruit-picking container.

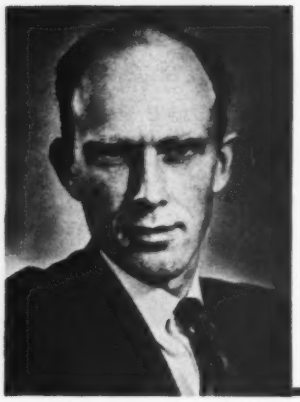
As regards bulk bins and pallets for transportation to the packhouse and store, British Standard pallets, on which the fruit is removed in units of 500–600 lb are favoured on some holdings. Experience has shown that Bramley apples transported in bulk bins and on pallets suffer a minimum of damage—indeed less than occurs when the fruit travels on the traditional trolley and trailer. Correctly designed bulk bins are likely to prove most useful in those mature orchards with a history of regular cropping and high yields. The heavier the crop the more closely are the bins placed in the orchards, thus reducing to a minimum the pickers' travelling distance from the tree to bin and return. Growers have found that pickers like gathering into bins; indeed, harvesting rates are frequently increased by 8 to 10 per cent when such containers are used.

In the packing shed the problem of unloading fruit from the bins may prove difficult to solve. An intensification of mechanical handling is one answer, but an annual crop of not less than 300 tons may be required to justify the capital investment. Fruit storage in bulk bins presents a further problem because most conventional cold and controlled atmosphere stores in this country were designed to hold bushel boxes or 26-lb tomato-type trays. To facilitate handling in bulk, wide doors are essential, and it makes movement and stacking easier if the cooler is sited on a wall of the chamber. Most new stores are designed for mechanical loading and unloading, and a 15 per cent economy in space is achieved by storing in bins. Most of them are built to the size of a British Standard pallet, 40 × 48 inches and 21 inches in depth, holding approximately 16 bushels and costing £4–5 apiece.

The problem of transferring the fruit from bin to grader is being solved in some packhouses by the introduction of flotation units. The bins are fork-lifted to the top of a 1,400-gallon water tank and then lowered hydraulically into the water, where adjustable jets convey the apples on to an elevator to pass through a cull eliminator, drier and polisher and on to the sorting elevator and grader.

I am convinced that the future of Bramley growing lies in the production of heavy crops of large, good quality fruits, more likely than not graded into two qualities and two sizes and marketed loose in well-lined wood or fibre-board cases.

E. C. Herwin, N.D.H., is County Horticultural Advisory Officer for Kent in the N.A.A.S. He is the son of a Norfolk farmer and was a heavy bomber pilot in the R.A.F. during the second world war.



Yellow Rust of Wheat

D. A. Doling

YELLOW RUST is the most important cereal rust in Britain. In some seasons it will appreciably reduce yields of the more susceptible varieties of winter wheat and occasionally spring wheat. The cause of the disease is a fungus—*Puccinia striiformis*.

First symptoms, which may be seen as early as March or as late as July, are the appearance of tiny orange-yellow pustules of spores (uredospores) on the upper surface of the leaf. In young plants these are scattered over the leaf surface; in older plants they develop in stripes along the leaf blade. As the disease increases in severity, the stripes lengthen and become more numerous until all the leaf is yellow with spores and dead leaf tissue; but it is usually still possible to detect the linear arrangement of the spore pustules—a feature unique to this disease. Occasionally, as the plants mature, the stripes turn black, particularly on the leaf sheath, as a second type of spore (teleutospore) develops.

In severely infected plants the photosynthesizing leaf area is considerably reduced and the ears contain only partially filled grain. In consequence, the total grain yield is reduced and the proportion of tail corn increased. When yellow rust infects a susceptible variety early in the year and rapidly increases in severity attacking all the leaves and even the ears, yield losses may be over 20 per cent.

Survival of the fungus

The fungus can survive throughout the year only as mycelium within the tissues of a living host plant. It spreads to clean plants by the development and dispersal of uredospores. Winter wheat seedlings become infected during the autumn and the fungus remains within the plants throughout the winter and early spring. Spore production is slowed up during this period, but some pustules are formed. In severe winters or in crops exposed to frost or cold, drying winds, the fungus has little chance of survival.

From the scattered infected plants which do survive the winter the disease will increase rapidly—to devastating proportions if there are warm, moist weather conditions during late spring and early summer. During this period,

susceptible varieties of other winter wheat crops, and later, spring crops become infected.

Hot, dry periods, as often occur during June and July, check spore production and cause withering of infected foliage and death of the mycelium. If these high temperatures occur early in June the crops have a sufficient interval, before ripening begins, to recover from the effects of the disease. But if the high temperatures occur late or not at all, the depression of yield may be very serious.

Spring wheat crops lag behind winter wheats in their development by about three weeks and thus have a much longer period in which to nullify any adverse effects on yield. We have found that a check to yellow rust development most frequently occurs too late in the season for winter crops to recover, but early enough for the spring crops to do so. Low yields as a result of yellow rust are, therefore, more frequent in crops of winter varieties than of spring varieties.

Danger years, following bad harvests

As the wheat plants mature and the leaf tissues die, so does the fungus. This occurs first in the winter crop, but the survival of the fungus is prolonged in the later-maturing spring crops. Dry harvest weather promotes rapid, even ripening of the grain and quick harvesting followed by clean, efficient cultivations. With such weather it is possible to obtain a period of several weeks between successive wheat crops during which very few wheat seedlings are present and hence little host material is available for the survival of the fungus. Under adverse harvesting conditions many late tillers arise from the base of the plants and stay green after the remainder have matured and many volunteer seedlings from lodged ears and shattered grain become established. Rust spores spread from spring wheat crops to these green plants.

If, as is most probable, many of these are not completely buried by subsequent cultivations, the fungus is able to survive and produce spores which

Stripes of yellow rust uredospore pustules

Wheat samples from a healthy crop and from a crop severely attacked by yellow rust, where the grain is badly shrivelled

disperse to infect the new winter wheat crop. Severe epidemics are, therefore, more likely in years following bad harvests.

Spring wheats are not often infected severely enough to affect yields, but their role in the over-summering of the fungus is an important link in the survival of the rust fungus from one crop to the next.

The development of an epidemic depends upon the complex interaction of many factors throughout the year. Although the general principles governing epidemic development are known, precise information enabling the forecasting of such bad outbreaks is at present meagre. In recent years severe epidemics occurred in 1946, 1952 and 1961; moderately severe attacks in 1948, 1949, 1954 and 1957.

The rust in other host plants

Certain grasses and varieties of barley are attacked by specialized forms of yellow rust which do not attack wheat. The incidence of disease on such plants does not, therefore, constitute a danger in wheat cultivation, but the form attacking barley could reach epidemic proportions.

Barley crops in Holland and Germany were seriously affected by yellow rust during 1961 and 1962, but only slight infections were seen in these two years throughout Britain, both in farm crops and at N.I.A.B. trials centres. But the possibility of yellow rust becoming of greater importance in barley than hitherto must not be overlooked.

At present most barley is spring sown and the long winter period without barley adversely affects the survival of the barley form of the rust. As long as this practice continues the disease is unlikely to rise in importance, but should the increasing interest in winter barley varieties now being taken by many farmers result in the shortening of the gap over most of the barley growing areas, then a radical change in the situation may be expected.

International co-operation

Since 1956 plant breeders and plant pathologists in European countries interested in the problems of yellow rust and its control, have co-operated in a study of the disease. Some 150 observers in twenty countries have made

detailed observations on the development of yellow rust in their locality each year. The data so obtained have been collated and analysed at Wageningen, Holland. The aims of the project have been twofold: the first has been concerned with the origin and development of rust epidemics in the different localities; the second with the range of diversity and the distribution of different races of the wheat form of the fungus.

Many such races have been identified by individual research workers during the past fifty years; 57 races have been described. However, during the course of the co-operative project only twelve races have been recognized in Europe. Eight of them have been isolated from British material, as well as from material collected in other European countries, but only two of these have been isolated frequently.

All wheat varieties accepted for trials at the National Institute of Agricultural Botany are intensively tested with these two races and certain other races in order to ascertain their resistance to yellow rust. Special tests have been devised and are conducted in glasshouses and experimental plots at Cambridge each year. Additional information on the field behaviour of many of the varieties is obtained from observations made at each of the Regional Trials Centres of the Institute. Information on the relative resistance of each of the recommended varieties of winter and spring wheats is included in the N.I.A.B. Farmers Leaflets.

We must look to resistant varieties

Weather conditions largely determine the severity of epidemics in any year but growers can take positive action to avoid serious losses in yield. Clean cultivations after harvest reduce the number of seedlings on which the rust is dependent for survival. Attention to such cultivations is most necessary after bad harvests when many green plants are present and large numbers of these are likely to be infected, especially where continuous winter wheat is grown.

Varieties of both winter and spring wheats differ widely in their resistance to yellow rust. Of the varieties on the N.I.A.B. Recommended Lists, some, like Hybrid 46 and Atle, are very resistant to all races of the wheat form of yellow rust known in this country. Others, such as Milfast and Jufy I, are rather susceptible to all races and Professeur Marchal, Cappelle-Desprez, Banco and Phoebus fairly susceptible to certain races only. Many other varieties are extremely susceptible to yellow rust, and for this reason are excluded from recommendation.

The cultivation of resistant varieties offers the only protection against large yield losses in years of severe epidemics. This is of greater importance in winter wheats, since they are attacked more frequently. However, resistance in spring wheats is also desirable for combating the oversummering of the disease.

The rust fungus is not static, but, as a living organism, is always evolving new races which may overcome the resistance of its host. Constant testing of all varieties with fungus material gathered throughout the country each year is essential if varieties possessing a high level of yellow rust resistance are to continue to be available to the farmer.

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ZIPPER DRAINAGE with plastic pipes is an interesting development which the Ministry has under test

A. N. EDE

New Methods of Field Drainage

WELL-CARRIED-OUT field drainage is a permanent farm improvement. It is quite common to hear of conventional tile drainage schemes which are still in operation after a hundred years or more, and the Ministry is able to grant-aid schemes that involve the use of new products only where an assurance can be given that a reasonably long life is likely for all the new products used.

Before the go-ahead can be given for an entirely new product, at least two years of field testing is usually required. The features which need to be checked include strength and stability, and the ability of the product to conduct water effectively for an indefinite period.

The Ministry's Land Drainage Division has a scientific section to conduct these field trials and supplement them by comparative laboratory tests. This

The mounted mole-plough with tube-laying attachment and a length of 2½ in. tube drawn out. In the foreground is an outfall pipe with removable collar and fixing cone
(Patent applications have been filed on the novel features of this machine)

The tube laid in a band of ironstone rock. Material has been packed down to close the slit by means of a wedge device, maintaining the plastic tube quite circular

section tries to keep abreast of developments at home and abroad, and to run preliminary trials in liaison with manufacturers. Some prototype products never survive such tests, and those manufacturers who originally may have had doubts as to the necessity for having an extended trial period before products become freely available to the farmer have come to appreciate the value of a thorough programme of testing and development. It is most important that products which may eventually become fully acceptable, and which may offer greater economy both for the farmer and the Exchequer, should not get a bad name by being released prematurely.

Experiments with new laying techniques

Some new products require new techniques or machines to install them. Often the product would be no good unless installed by a particular method, and it is then necessary for the Ministry to subject the whole technique to testing in the field.

In this connection some interesting work has been carried out with plastic tubes. Three years ago preliminary field tests with ready-made P.V.C. tubes were carried out on Mr. J. J. A. Kendall's farm at Ingham in Norfolk. The method of installation was by dragging in 250-ft lengths of tube of 3 in. diameter behind a mounted mole-plough. Although the tube proved strong enough as a drain, there was some difficulty in dragging in sufficiently long lengths without breakages. As a result, it was thought that plastic sheet or foil might offer a better prospect, the drainage tubes being formed on the spot from long ribbons of the material, with the edges seamed together by a zipping method. (Previous work in the U.S.A. using plastic sheet had shown that a tube with no seam but a simple overlapping joint was not satisfactory for all conditions.) A few months after the Norfolk field work, the Ministry had constructed a machine believed to be the first of its kind to operate on the seaming principle. It was mounted on a tracklayer.

Although soil conditions caused disturbance in this field to be unusually great, it was unnecessary to remove cattle during the laying

In May, 1960, the machine made a successful first run, making and laying underground at normal tractor speed a 2½-inch drain. Two identical strips of material were used, each made from a toughened P.V.C. ·015 inches thick and 4¼ inches wide. They were passed down a guide into a channel made by the mole-plough blade and were then formed into a tube by the zipping principle, making use of an interlocking pattern formed on the edges of the strip.

Since that time the effectiveness of the drain and machine has been greatly improved, although the original principle has remained almost unchanged. The development work on the materials and latterly on the details of the machine has been carried out by manufacturers working in co-operation with the Ministry. During development, information has been accumulated by means of field trials in various parts of the country concerning the drains and the method of laying them in a range of soils. Work on similar lines carried out in Ohio by J. Fouss has confirmed the effectiveness of the interlocking seam with drains as large as 3 inches.

Ministry's experimental plastic drain-layer

Today the machine can lay a continuous length of plastic drain up to 1,200 feet long in a few minutes. It is controlled by radio, which enables a technician on the ground, with an optical level sighted on the machine, to keep it on a true gradient. Perforations in the plastic allow water to enter the drain from the soil. Where heavy clay soils or silting conditions are encountered, an extra attachment can be fitted to allow for a substantial thickness of gravel, up to one inch size, to be placed as a cover to the plastic drain. In situations where mole-drainage or busting is called for as an ancillary operation, the plastic adaptor can be stripped off in a few minutes and the machine can then be used as a mole-plough.

A fully mounted mole-plough of this type is more favourably placed than a conventional machine to get maximum track grip from the tractor and to

reduce the drawbar pull required for mole-drainage. The hydraulic control cuts down to the minimum the amount of time wasted on the headlands, and the floating action of the plough reduces considerably adverse ground conditions. The productivity of this implement is thus well above that of an ordinary mole-plough, quite apart from the time saved as a result of its dual role as a pipe-layer.

What is the purpose of this Ministry equipment? Primarily it is a dispenser, for enabling test lengths of new drainage materials to be installed in the ground under practical conditions as soon as prototype products become available. It is intended that both tubing and permeable back-fill materials will be tested by this machine; for the tubing, the particular relevance is to materials in sheet form to replace 3-inch tile drains. This method of installation has been chosen on the grounds that the only way to secure a substantial economy in field drainage costs is by a simultaneous change to new materials and to continuous laying techniques.

Plastic drainage could be cheaper

It seems unlikely that any radical change in prices per chain of drain can result from the modification of conventional methods—for instance, by substituting something new for tile drain tubes or by improving trenching performance—although the achievement of minor economies by such methods is to be encouraged as an interim measure. But with tiles in many areas at rock bottom prices, and with the cost of drainage dependent largely on labour and overheads which tend to rise rather than fall, there remains little opportunity for any significant reductions in the cost of field drainage carried out by conventional methods.

The line of sight set up on the level is parallel to the path of the drain. The observer maintains a mark on the machine on the line of sight by means of the switch in his hand and the radio link to the tractor hydraulic system

The difference with a technique like continuous plastic drain laying is that most of the direct cost of drainage (about 75 per cent) is represented by the plastic material, which on the whole is the type of product which tends to become cheaper because of technological advance combined with larger markets. So the long-term prospect is distinctly more promising. In the short-term, the cost of plastic drainage is not likely to be much below that of tile drainage for an equivalent size of drain, and it is dependent both on the Ministry becoming completely satisfied that a good job can be done in plastic and on the farmer becoming confident enough to ensure a reasonable demand.

The introduction of a new product inseparably linked with a fresh method of installation raises considerable questions of drainage plan, depth of installation, size of tube and the necessity for permeable fill. The investigations now going on are likely to lead to a good deal of re-thinking on these subjects and, it is hoped, will act as a stimulus to an industry which has been making only slow progress in recent years for lack of technological advances.

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The Ministry's Publications

Since the list published in the January, 1963, issue of *Agriculture* (p. 36) the following publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable from Government Bookshops (addresses on p. 100), from Divisional Offices of the Ministry or through any bookseller at the price quoted.

BULLETINS

No. 174. Poultry Nutrition (Revised) 6*s.* 6*d.* (by post 6*s.* 11*d.*)
This Bulletin presents, in an easily readable form, the scientific basis upon which a successful poultry feed programme can be built. Growth stimulants are fully discussed and there are sections on metabolism, vitamins, minerals, and vegetable and animal protein foods. It is a valuable guide for poultry farmers, advisers, teachers, compounders and students.

LEAFLETS

Up to six single copies of Advisory Leaflets may be obtained free on application to the Ministry (Publications), Ruskin Avenue, Kew, Richmond, Surrey. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (by post 6d.)

ADVISORY LEAFLETS

No. 215. Gooseberries (Revised)
No. 219. Grain Weevils (Revised)
No. 515. Compound Fertilizers (New)
No. 516. Control of Rats and Mice by Warfarin (New)

Philip Burton *is enthusiastic about wire floors. His ideas and description of his methods with heavy broiler breeding stock will be read with interest*

Broiler Breeding Stock on Wire

In my opinion, welded wire mesh is essential in modern poultry-keeping. During the past few years I have kept poultry of all ages on it, sometimes with access to litter in various quantities and sometimes on all wire. The points mentioned in this article and the figures given regarding floor space, etc., relate to heavy broiler breeding stock, and this fact should be kept in mind if the reader is thinking of converting an existing deep litter house to a wire-floor house. With light crosses or hybrids, the stocking rate could be considerably higher.

Brooder house

My present brooder house is a Nissen-type building, with a two-inch air space, one inch of fibre-glass carried on a wooden frame and a lining of vapour-sealed hardboard. There are controlled air inlets at each end and ventilators in the roof. The house is divided into sections of 90 sq. ft, and each section accommodates 180 day-old chicks under a 200 size 'electric hen'.

The whole of each section is of $\frac{3}{4}$ in. $\times \frac{3}{4}$ in. galvanized wire mesh carried on a wooden frame 7 in. deep. Each frame is about 25 sq. ft for ease of handling. Other sizes of wire have been tried. Size 1 in. $\times \frac{1}{2}$ in. was rejected because the young birds caught and broke their legs in it during the night; $\frac{1}{2}$ in. $\times \frac{1}{2}$ in. made a good floor, but was too small to clean properly.

A 7-inch depth of frame at the above stocking rate will take care of the droppings until the birds are six weeks old, when they go out on to range. The sections in the brooder house are served from a central passage-way, so that the attendant can do most of the feeding and servicing without stepping on the wire floor. The partitions between sections are 24 in. high and, although the birds fly on to them from three weeks onwards, no serious trouble has arisen through crowding in any one section.

A piece of calico 6 ft $\times$ 5 ft is laid on the wire mesh under the brooder for the first 7–8 days. To this area, surrounded by cardboard, the chicks are confined for the first 3–4 days. During this time they are fed from egg trays and watered with six pint glass drinkers. At about the eighth day these are replaced by meal troughs and float controlled water supplies. A shallow tray, forming the cover of the brooder, holds an inch of sawdust and acts as a dust bath.

When the brooder is removed at about four weeks, the tray stands on the wire floor and gives the birds some interest, keeps them clean and stops feather pecking to a degree. This method of brooding on 100 per cent wire has superseded the part-wire part-litter house, and the health of the birds is greatly improved. Twenty-four hour lighting is maintained for the first two days, giving the young birds plenty of time to feed and drink, so enabling them to get off to a good start. After this the lighting period is gradually reduced until it coincides with the hours of natural daylight. Thus when the birds go on range there will be one less stress with which they will have to contend.

Rearing on range

At six weeks the birds are put out on range. The shelters have open wire fronts 1 in. × 1 in. welded wire mesh floors raised 6 in. from the ground, and corrugated iron roofs with 9 in. wooden sides. These are on skids and are moved their own length every three days. Several methods have been tried to make the birds keep to their own shelter, or at least not to overcrowd. So far the best results have been achieved where the shelters have been spaced about 18 in. apart.

When the birds are put into the shelters at six weeks, they are shut in for two nights and a day, with food and water inside with them. This gets them used to roosting in a shelter and to the fact that it is their home. After this we have no trouble with 'sleeping out'. After the second night the birds are released into a wired run about 10 ft × 30 ft, with food and water-troughs placed near the pophole of the range shelter. They are confined to this area (about 5 ft per bird) until at eight weeks the wire fences are removed. For the rest of their rearing life the birds have truly free range.

This wiring in for the first two weeks of range life helps the birds considerably to recognize their own shelter and their 'fellow room mates', so saving some of the troublesome crowding later on.

From 6 to 8 weeks, whilst the birds are confined to the wire runs, meal is fed *ad lib.*, but after the eighth week a gradual change is made to pellets and grain so that at ten weeks they are having all their food on the ground. The pellets are poured straight from the bag—a 56 lb bag makes a trail about 40 yards long. This is the ration for 450 pullets. The grain feed in the afternoon is scattered, and in our own case is done with a fertilizer spinner drawn by a

Nest-box resting on the wire floor. The 3 in. × 1 in. wire shown here is now being replaced by 1 in. × 1 in. wire

Land Rover. Twelve pounds of barley is fed to every hundred birds. During the whole of the rearing period water is in ample supply, and flint grit is fed periodically in open trays.

Rearing on wire

To get a true comparison between extensive and intensive rearing, 500 pullets from a batch of 1,500 were reared intensively on 60 per cent wire and 40 per cent litter. No lighting was used. The birds got the same hours of daylight as those on range. They were fed meal instead of pellets—13 lb per hundred and 11 lb of grain (barley), as against 12 lb on range. Those reared on range reddened up much earlier, but when given laying meal *ad lib.*, the intensive birds responded much quicker and came into lay one week sooner than those on range.

Laying quarters

At point of lay the birds are put into houses with part wire floors and part litter. The percentage of wire has been varied and seems to have no significant effect on egg production. One batch of heavy breeding stock housed on two-thirds wire and one-third litter at a stocking rate of 1·7 ft per bird gave the same production figure per bird per month as a batch of the same stock on 100 per cent litter at a stocking rate of 3·5 sq. ft. The hen housed average was higher on wire, due to a slightly lower mortality. This means that for the cost of installing a wire floor in a normal poultry house, egg production can be more than doubled.

Communal nest-boxes are used throughout, allowing 1 sq. ft per five birds. They have solid floors, which are covered with two inches of clean, dry, soft-wood sawdust. It is important not to use oak or other hard-wood sawdust, as it may stain the eggs and can impart a taste to them. Much experimental work has been carried out with the nest-box floors: slats, wire-netting, welded wire and hessian have all been tried, and for various reasons have been rejected. Sawdust on a solid (hardboard) floor, dusted with a little disinfectant powder, keeps the birds and the eggs clean.

To start with, the nest-boxes were hung on the walls, about 20 in. above the litter, with alighting perches in front of the popholes, which is common practice in deep litter houses. We found, however, that the birds, having jumped down from the wire floor to the litter, were disinclined to jump up again to the nest-box. The result was a heavy lay of eggs on the litter in the darkish corners under the nest-boxes.

We re-sited the boxes with one end supported from the roof timbers and the other end (the pophole end) resting on the wire floor. This enables the bird to walk straight from the wire into the nest, and the floor egg has become rare; in fact, less than half of one per cent are laid on the litter.

We started with 3 in. × 1 in. × 10 G welded wire mesh, but as the odd bird caught its shank in the gap, we changed to 1 in. × 1 in. × 12 G. In my opinion this is the best size for adult poultry. It gives the bird a more secure foothold (an important point when keeping breeding stock), it does not sag so permanently when walked on, and it is just as easy to clean.

The author of this article is well known in Montgomeryshire for his progressive ideas on poultry-keeping. On his five-acre farm at Guilsfield, Welshpool, he carries some 2,000 birds, all Arbor Acre broiler breeding stock.

1. Twrcelyn, Anglesey

W. O. Elias

ANGLESEY, the most northerly of the Welsh counties, is geographically an island. But through man's ingenuity it is now linked to the mainland by both rail and road bridges. The beauty of Menai, the gateway to Anglesey, and its world famous bridges have been the admiration of millions of people over the last hundred years. It is a county of fertile soil with a great grain-growing potential, and to this is attributed the title of 'Mon Mam Cymru'—Anglesey the Mother of Wales. Perhaps this should be the granary of Wales, because it has been claimed that Anglesey has the capacity to provide all the cereal needs of the Principality.

Twrcelyn, a name handed down from the early middle ages, was the original term used to define one of the administrative 'commotes' of that period. It is still used to identify the north-east district of the County, which contains twenty-one parishes, extending to 58,000 acres, and provides a home for 13,500 rural dwellers. The north and east boundaries are formed by the Irish Sea, where ships on the world trade routes slip silently by, stopping only momentarily to pick up or discharge the pilot who ensures a safe passage through the treacherous tidal bay to and from the Mersey.

The coast is rocky, the currents swift and strong. The bays and coves, now the summer haven of so many visitors, were once the shelter of smugglers of centuries past. The storm-swept coastline has been the scene of many a disaster, the most tragic being the loss of the *Royal Charter* on 26th October, 1859, in one of the worst gales ever recorded. The death by drowning of 400 people, with the loss of a huge cargo of wool and skins plus gold bullion worth half a million pounds, still conjures a frightening tale in the minds of local inhabitants. Legend has it that only four-fifths of the gold was ever recovered. A hundred years later almost to the day, 27th October, 1959, the motor ship *Hindlea* met a similar fate, but due to the bravery of the captain and crew of the Moelfre lifeboat no lives were lost. In recognition they were duly honoured by a grateful nation.

The people are Welsh by birth, islanders by environment, and agricultural by necessity; and it is true to say that all live on or by the land. The district is gently undulating, treeless and windswept, except for sheltered pockets.

The rock-scarred fields are deceptive in soil depth and fertility, and are capable of growing most crops that are not affected by the harsh, salt-tanged winds of the sea. The rocks are pre-Cambrian, one of the oldest rock formations found in the British Isles. The upper soil layer consists of glacial drift (boulder clay) varying in texture from heavy clay to light sandy loam. The highest land mass rises to a bare 600 ft and is affectionately described locally as Bodafon Mountain. The County Water Department has used this point of vantage to construct its reservoir of pumped water, which is distributed by gravity to the whole of the county. The lakes and rock basins are the result of glacial action. The largest, 'Cors y bol', has already been earmarked for use as a reservoir of drinking water to augment the domestic supply and to provide the large quantities that will be needed for the new nuclear power station to be built at Wylfa. The site is a rocky headland that juts out into the Irish Sea.

The climate is oceanic; the temperature difference between coast and centre is very small, but the mean winter temperature of the district compared with that of central Wales is advantageous. Snow is a rarity and on its infrequent visits remains only for a few days at the most. Strong winds are prevalent and the air is seldom really still. This is evidenced by the large number of derelict windmills dotted over the district, a reminder of the days before electricity and oil became the sources of motive power.

Farm structure is a problem. The district has the highest percentage of small farms in the county, 1,352 holdings occupying a total of 58,000 acres and only 610 holdings exceeding 20 acres. The farming is mixed, with milk from small dairy herds the mainstay of farm incomes. The close proximity to Ireland and the availability of store cattle from Caernarvon and central Wales, plus the fattening pastures of the county, have always tended to favour beef from grass. The same feature is true of fat lamb production; the low capital cost of draft Welsh Mountain ewes direct from the hills of Gwynedd enticed the farmers to develop this mode of production. So fatstock production still remains the major farm enterprise. The records of cattle show that 20 per cent are in the over-two-year group and that the population of steers to heifers is in the ratio 2 to 1.

Other industry in the district is limited to the bromide works at Amlwch, a small town with a once-busy harbour that was the outlet of the copper from the world famous Parys Mountain mine. Up to the end of the nineteenth century this was the largest in Europe, but the site is now derelict and the closing of the mine caused a serious de-population of the area.

The district is far removed from the hurly-burly of the industrial midlands, but it has become the summer home of hundreds of people who, seeking the peace and quiet of a rural countryside, are at the same time able to enjoy the unpolluted air and gaze in wonderment at the unspoiled beauty of sea and mountain.

It is said that when Gladstone visited Parys Mountain and stood on the point of vantage surveying the emerald green carpet that spreads unending towards the hills of Snowdonia, he lifted his black stove-pipe hat, paused, and exclaimed to everyone's delight 'Well done, God!'

W. J. PINFOLD
Agricultural Land Service, London

Work Study in Building Design

As much as 60 per cent of a farm's labour may be spent on work in and about the farmstead, so it is not surprising that most agricultural work studies are concerned with building routines. In spite of growing interest in labour-saving buildings, however, designs today are still based on arbitrary standards intended to satisfy the physical requirements of stock and equipment.

Good standards of accommodation and correct environmental conditions are of course necessary so long as these can be provided economically. But, in seeking perfection, it is often overlooked that the financial success of an enterprise can depend as much on the man using the building as the building itself. It may be costly and dangerous optimism to assume that a worker can adapt his working methods to a building after it has been erected. Or to think that they will automatically include the basic requirements of good husbandry.

It is surely not unreasonable to suggest that the needs of the farm worker be given the same consideration as the needs of the livestock he attends. Yet every work study shows some instance of faulty design in a building or equipment which is obviously due to inadequate consideration of the work method. Every farm has an example of badly-sited doors, taps or light switches. But all the miles of unnecessary walking caused by these simple errors are nothing compared with the unsuitability or bad maintenance of the equipment used for moving materials about the farmstead.

Without considering quantities and methods of handling, it seems impossible to establish any principles for siting one building in relation to another. Does it matter whether the Dutch barn is twenty feet or one hundred yards from the covered yard if straw and fodder have to be loaded on to a trailer? The answer will depend on whether it is necessary to do the job at all, which method will take the longest time and if there is any difference in the physical effort required.

It will need several years of intensive effort on the part of work study specialists before all the alternative methods of doing work about the farmstead can be recorded and published as standard data. However, this

does not absolve the farmer or the building designer from responsibility. Although accurate times may not be known, it is still possible to compare different work methods. Seeking the cause of every operation which is not productive and eliminating all except essentials is a matter of common sense, ingenuity and persistence.

A farmer should be able to look at a plan of a proposed building and imagine himself going through every action of a day's work. He will know whether he is making it easy for the man to do all the things that should be done and difficult for him to fall into errors of human judgment. At the same time he might well look at his existing buildings and ask whether they are really the cause of high labour costs—or whether a different management system and some minor alterations to the equipment and fittings could avoid capital expenditure on the new building.

Labour surveys have shown that there can be as much as 30 per cent difference between the average and the premium farmer. Work studies have shown that even the best farmers can improve labour use. Frequently the savings in labour have little to do with the building layout, and if the existing buildings are badly used there is no reason to suppose that new buildings will be used more efficiently. Perhaps a new building brings its own incentive towards efficiency by breaking away from traditional working methods. If this is so, it is a poor justification for capital expenditure. When the potential, rather than the actual performance of new and existing buildings are compared, it is not uncommon to find that the return on capital is coming from increased production rather than increased productivity. This may benefit the building industry but not agriculture.

For the building designer the main interest of work study must be the opportunity it affords to specify the working methods as well as the materials and structure. Too often in the past the designer has been accused of poor design when the building is being used in a different manner from that for which it was originally intended.

The study of milking parlours and yarding systems has made it possible to estimate with reasonable accuracy the labour requirements for different forms of management and to calculate the effect of change.

In pig housing the results have been even more interesting. The study of the limiting effect of trough feeding has led to increased stocking with 'off-the-floor' feeding, radical reductions in labour requirements and savings in the capital cost per pig.

This work shows that simplifying working routines can have the effect of making buildings more adaptable, without detracting from their immediate efficiency. Until it becomes possible to build short-life buildings, work study may be the answer to the perennial problem of buildings rendered obsolete by changing conditions.

Work study can no longer be regarded as an innovation. It is a proven tool of the farm building designer as well as the farm management consultant.

IN BRIEF

Light on Poultry

Decreasing lighting patterns during rearing give no positive improvement in performance but they do allow the bird to develop to its true genetic maturity. So said Dr. R. H. Jones, of Thornber Bros. Ltd., at the N.A.A.S. Annual Poultry Conference at Oxford. He pointed out that a bird reared on a constant six-hour day eats the least amount of food, whilst there is no significant difference between an 8-, 10- or 14-hour day. However, birds reared on a 14-hour day matured on average six days earlier than those on a 6-hour day. If an abrupt change in day length was being practised, it is better to do this as early as possible—at latest by the time the bird is four weeks old. There is a difference within strains of birds, and the poultry-keeper should follow the pattern which best suits his conditions of housing and management.

Mr. N. Grossmith, who farms at Aston Clinton and Dinton, said that his system could be looked after by relatively unskilled labour. He has tier brooders of 0–3 weeks, cooling cages from three to seven weeks and verandahs from seven weeks to housing, and thereby rears 1,500 birds per week with comparative ease. One week's rest is allowed between batches. He was emphatic that poultry-keepers want equipment that will last for much longer than five years and which will rear disease-free stock with the minimum of problems.

Mr. D. Humphrey, of North Winchester, favours wire floor rearing. In a house 144 ft long and 36 ft wide he rears 7,000 chicks to point of lay, and plans to increase this to 8,500. Welded wire 1 in. × 3 in., ten gauge is used, covered for the first twelve days with sisalkraft paper and litter. The house is of controlled environment type with an allowance for air extraction of 1¼ C.F.M.s/lb live weight. Out of 7,140 chicks housed at day-old, 6,941 were reared to point of lay; mortality was 2·8 per cent, including cockerels. His costings for a 16½-week-old pullet were:

	s.	*d.*		*s.*	*d.*
Food (13·6 lb per pullet)	3	10	Capital depreciation		11
Vaccination		2½	Electricity		2
Pullet	3	4½	Gas		1½
Labour (17 weeks at £4 10*s.*)		2½	Miscellaneous (litter, water,		
Cleaning house (£60)		2	office charges)		3
			TOTAL 9*s.* 3*d.*		

During the discussion opinions were voiced on whether light patterns were necessary for cockerels. Generally it was agreed that later sexual maturity occurred with a decreasing pattern and that the light should be increased by the 18th week.

Under normal conditions figures of one-fifth of a watt per sq. foot of floor space for white light and 1 watt for red were satisfactory. These figures give ¾ to 1 lumen per sq. foot. It has been found that at 0·3 lumens the photo-mechanism of the bird would continue to work but unfortunately the poultry-keeper would not!

D. Pollicott

Beef for muck, or money?

Potatoes and vegetables are the main crops in the Boston, Lincs, area, but at a recent N.A.A.S. meeting the question of beef for muck or beef for money came up for discussion.

Traditionally, the fattening of beasts in an intensive arable area is done on a high cake ration and *ad lib.* straw for production of FYM. In recent years, however, the profit on this type of system has disappeared and many farmers are looking for alternative methods of fattening bullocks or (unwillingly) giving them up altogether.

Two of the farmers present still have single-suckled herds of Lincoln Reds producing fat beasts at 18–24 months. Only one of them had dared to do any costings on his herd and he said he had broken even. He was pleased that he had got his FYM for nothing but ignored the opportunity cost of his grassland if ploughed up.

Several farmers bought in Irish stores in the autumn to fatten in the yards over winter, and some thought they had made a profit; but everyone agreed that the profit depended on the store price. These beasts did, however, produce a large quantity of FYM. Keeping beasts in yards raised the question of letting the yards in the winter for someone else's beasts. A figure of 10*s.* per head per week was quoted—the farmer supplying the labour, straw and roughages.

The semi-intensive production of beasts fat at 16–18 months, either off grass or out of yards with the farmer doing the job from rearing to finishing, raised two criticisms. First, if stores are bought in the spring or summer the fluctuating price could take the profit, as with Irish cattle. Second, few arable farmers have suitable buildings or the kind of labour interested in rearing calves.

Speaking about the intensive barley-fed beast fattened at 12–14 months, a gross margin of £13 per beast was quoted, but most farmers at the meeting were less enthusiastic over the reasonable buildings layout required and the high standard of stockmanship in labour that would almost certainly be necessary in the fields during the summer.

It seems at the moment that many farmers are prepared to risk the high store prices in the autumn or give up fattening beasts altogether, rather than introduce a newer, more intensive method of fattening. Some, however, have solved the problems of rearing by buying three-month-old calves and have maintained their profit on beef with a good stockman and suitable existing yards.

Shades of Lucullus

How old do you like your beef? This, in effect, was the question recently put (if more succulently) to ninety people in Devon by the Dartington Hall Cattle Breeding Centre and the N.A.A.S.

These fortunate people spent an evening testing uniformly cooked joints of traditional grass-fed beef and locally produced barley-fed baby beef (Friesian and S. Devon). They were then asked to comment on the respective flavour, tenderness, appearance, and cooking qualities. Nearly 70 per cent of them were able to distinguish between adult and baby beef, especially when the meat was served cold.

In a following test, 79 families were given joints of meat to cook at home and report on. Being questioned about quality, 72 per cent thought that baby beef was more tender than meat normally received from their butchers; 51 per cent thought that baby beef was good or very good, 22 per cent thought it satisfactory, 27 per cent considered it only fair or poor. On the question of appearance, 36 per cent of the tasters felt that baby beef was more attractive than traditional beef and 50 per cent stated that it was as normal. Only 14 per cent said it was less attractive.

This survey derives, of course, from the considerable interest in the Rowett system, whereby animals are fattened within the year on a diet of concentrates and water, and which many farmers are already trying out on their farms.

Fertilizers on Permanent Grass

Reports on fertilizer usage in this country commonly emphasize how relatively little fertilizer is given to grassland, as compared with arable crops. At the same time there is ample evidence that both leys and permanent grass respond to more generous treatment, although the economic return from more heavily fertilized grass depends on the extent to which the extra production is profitably utilized.

Intensive fertilizer treatment combined with off-and-on grazing has proved successful for dairy cows, but this system of management has not been generally accepted for beef production and is flatly opposed to the traditional methods of the grazier in the famous fattening pastures of the Midlands. Here the system is based on set stocking at a rate which rises to a peak early in the season and is reduced by sales from June onwards. Care is taken to spread cattle droppings evenly, and little or no bag fertilizer is given.

Critics of this system, as of most successful farming techniques, have not been wanting, and it is often asserted that the output per acre from these pastures could be improved by the same intensive fertilizing and grazing methods which have been advocated for dairy cows.

So a particular interest attaches to a report on the economics of fertilizer application to permanent pastures issued by the Department of Economics at the University of Nottingham. This report is based on the results of twenty-two supervised field trials on commercial farms in the Market Harborough area. Their object was to compare the output from fertilized and unfertilized fields on the same farms and, since more grass does not necessarily mean more beef, the measure of output in each case was the total liveweight gain from the field during the season.

Of the two trial years, 1958 was one of the wettest ever recorded and 1959 one of the driest, so clearly the results from two such unusual years cannot in themselves be regarded as conclusive.

In both years the fertilized fields produced a little extra liveweight gain worth about £2 10*s*. per acre. It would however be reasonable to suggest that the amount of nitrogen applied (25 units per acre) was too small to bring about any real increase in productivity. More generous dressings might be successful in extending the grazing season. This would enable graziers to buy stores more cheaply a month earlier in spring and finish a higher proportion in early summer before prices start to fall. Clearly there is scope for further critical work on this aspect of the problem.

Besides describing the trials, the report contains a useful review of experimental work on the response of permanent pasture to fertilizer: also an appraisal of the significance that can be attached to records based on a number of field comparisons undertaken on commercial farms.

P. N. Harvey

Scholarships in Farm Management

The Frank Parkinson Agricultural Trust is again awarding six scholarships to enable suitably qualified persons to follow the one-year post-Diploma and post-Graduate Courses in Farm Management at Seale-Hayne Agricultural College, Newton Abbot, Devon.

Details and conditions of the scholarships are obtainable from the Secretary of the Trust, 45 Bloomsbury Square, London, W.C.1., who will also supply application forms. These have to be returned to the Secretary by 31st March, 1963.

Books

The Great Hunger. CECIL WOODHAM-SMITH. Hamish Hamilton. 30*s*.

The story of the famine resulting from the potato blight in Ireland is one of the greatest tragedies of the last 150 years; yet it is seldom remembered today, for it has no hero, no great dramatic climax. As in 1845 to 1848, it is still difficult to believe that a small, slimy fungus could so challenge man, put such a colossal spanner into such simple works, as to starve a million Irish to death and cause another million and a half to emigrate, let alone convert Peel to free trade, disestablish the church, sow the seeds of a republic and make plant biology a profession rather than a *dilettante* occupation.

Could a fungus do all this? Not by itself, but, aided by the stupidity of man, by self-interest, ineptitude, sheer bad luck and blind adherence to the theory of *laissez faire*, it did. Cecil Woodham-Smith tells this story with all the skill and insight she put into the story of the Crimea '*The Reason Why*'.

The narrative is grim, and as the well-documented book runs on it compels attention by the same horrible fascination as that of the Ancient Mariner to transfix the wedding guest. The fact is that the peculiar land-holding structure of Ireland had forced the Irish peasant down to a potato subsistence economy; he was always poor, frequently hungry, and when the blight took the potato crop he starved. Relief measures, at first popular in England, were mismanaged, bedevilled by Trevelyan, the principle of *laissez faire* and non-interference with legitimate trade. The starving Irish were not grateful for their pittance and talked of revolution and independence, which gave them a bad press and less assistance still in the third blight attack (1848).

Was it hatred of Ireland that led England to such a course? Mrs. Woodham-Smith says 'No', for a few years later a similar series of Government ineptitudes destroyed the English army in the Crimea. The real trouble was the amateur approach and the inability to modify theory quickly enough. This is not to say that the Government did not act quickly. Naturally it would not listen to the Rev. M. J. Berkeley, who said the cause was a fungus, but even if it had it is doubtful if the matter would have been much advanced, since the cure, Bordeaux mixture, was not found until 1882. Perhaps over-confidence was the defect of the science of that day, though this is hindsight judgment. The scientists were rushed in and failed as fearlessly and as foolishly as the politicians.

The only fault I find with *The Great Hunger* is that it contains no reference to the various technical books, so well printed and illustrated, that were so quickly produced. They were all wrong (except Berkeley); for instance, Alfred Smee, *The Potatoe Plant* (London, 1846) traced the trouble to an aphid.

Mrs. Woodham-Smith demolishes some of one's favourite *canards*; for instance, Queen Victoria did not subscribe a mere £5 to the relief fund, but headed the list with £2,000; nor did she autograph the *Book of Kells*, but a vellum leaf later bound with it.

It is a measure of the interest of this remarkable book that as one reads, questions on the anomalies of the situation continually arise—the eternal contradictions of Ireland. Grain was exported from Ireland, in the sacred name of non-interference with business; why were the waggon trains not attacked more often? The peasants sold everything of the little they had to buy food; who bought these poor objects? In the worst year (1848) Queen Victoria paid a State visit, a substitute for food; why was her tour a popular triumph? How could the officers of an American food relief ship and the leading citizens sit down to a luxurious banquet in starving Cork?; and whence came the food for it?

Naturally the Irish patriots, calling for liberty, could not raise rebellion in a starving population, and even if they had liberty would not have produced food. The final paradox is that two of them, John Mitchell and Terence McManus, reached America and later supported the slave states in the Civil War, one with a newspaper and the other as a general in the field.

G.O.

The Smallholder Encyclopedia. Edited by JOHN HAYHURST. C. Arthur Pearson. 42*s*.

In this new edition of the well-known encyclopedia, the section on horticulture includes information on practically all aspects, and has been prepared in a manner to suit either the commercial or the domestic producer. The impossibility of providing detailed information on all subjects in an encyclopedia is apparently appreciated, as reliable sources of further reading are frequently mentioned. Practically all the recent developments in horticultural techniques are described. Lists of varieties are generally up-to-date, although the newer and more productive varieties of sweet corn are not included. The description of the cultivation of mushrooms in glasshouses does not fit in with commercial practice; for example, peak heating in a glasshouse is hardly a practical proposition.

Reference is made to a number of herbicides and their uses, but the approach to this subject is rather cautious in that several commercial practices, now generally accepted, are not mentioned. This may well be the right attitude to adopt if the book is compiled mainly for the use of the domestic producer and smaller commercial grower.

One minor omission was noted. On page 22, 'Bush Tomatoes' are mentioned and the reader is referred to 'Tomatoes'. A detailed search failed to find any further information on this crop, except for an indirect note under the heading 'Ring Culture'.

The section on agriculture includes chapters on bees, rabbits, fur farming, dogs, goats, pigs, farm livestock and poultry. It covers almost everything relating to the rearing, handling and management of the livestock, with notes on the prevention and control of the pests, diseases and disorders which may afflict them. In this section reference is also made to official bodies and others to whom application can be made if more detailed information is required on specific subjects.

The book is well printed on excellent quality paper. Many of the newer techniques and developments are covered by clear and helpful illustrations, which are again of top quality. It can be said with confidence that it contains a wealth of reliable information, and that it will meet the needs of many who get their living or their recreation from the land or from livestock. *A.D.H.*

Destructive and Useful Insects. Their Habits and Control (4th Edition). C. L. METCALF, W. P. FLINT and R. L. METCALF. McGraw Hill. 135*s*. 6*d*.

The publication of a new edition of this comprehensive reference work is of considerable interest to all entomologists and agriculturists. First published in 1925, the successive editions have been invaluable to students, farmers, horticulturists and advisory officers in North America, and the treatment of the subject has been sufficiently thorough to justify its use in Europe and other parts of the world.

It is therefore unfortunate that the scope of the volume was not extended to include pests from countries other than the United States, particularly as the authors expect it to be useful in countries as far apart as Australia and India.

This book, however, covers more than a thousand pages already, and it is probably asking too much to expect all the aspects of economic entomology to be covered in one volume. It may well be preferable, in future, to make such sections as Biology and Control separate volumes, that can be revised independently.

The layout is similar to that of previous editions, but the sections on Morphology, Physiology and Biochemistry of Insects have been condensed into a single concise chapter. The chapter on Insect Classification has been rewritten and expanded to give brief accounts of the many insect families that include pests among their representatives, and those on control and insecticide application have been brought up to date, the latter being especially exhaustive and well written.

The fundamental principles underlying insect control are emphasized in a way that is noticeably absent from other textbooks. Finally, the list of pests dealt with has been extended and modernized and the latest specific control measures outlined. It is a pity that assessment of the damage done by pests and the economics of their attacks are not discussed.

The mixed quality of the illustrations of previous editions has been one of the weaker features of the book, and many have been replaced in the new edition. Unfortunately a few of the poorer ones still remain, and the quality of reproduction of some of the diagrams still leaves a great deal to be desired. References are rather abbreviated and, in common with many other American texts, take insufficient note of European publications.

Nevertheless the book is exceptionally valuable, particularly in the way it deals with pests under the headings of crop or

other host. It is in its effect on his crops and animals that the agriculturist first notices a pest attack, and it is in this context that he prefers to identify and combat it.

C.A.E.

Clouds, Rain and Rainmaking. B. J. MASON. Cambridge University Press. 22*s*. 6*d*. (Paperback 13*s*. 6*d*.)

Rarely a month passes without some reference in the Press to either rainmaking or hail prevention. Far more rarely is it possible to obtain firm unbiased statements on the results of such attempts. The layman has been bedevilled between the enthusiasm of the optimists and the apparent conservatism of the 'establishment'.

It is therefore very welcome to have this book by the Professor of Cloud Physics at the University of London, in which he gives an exposition of our existing knowledge on the subject and a very reasoned judgment on past claims to weather modification and future hopes.

Primarily, it is a book written by a physicist for those with a scientific education, and only one of the seven chapters deals directly with rainmaking as such. This is unavoidable, because it is impossible for anyone to understand the discussion without an appreciation of the nature of clouds and the physics of rain, hail and snow formation.

It seems probable that in some experiments, under restricted favourable conditions, local increases of precipitation have been brought about by artificial stimulation; but the local increase in rain or snowfall was of the order of 10–20 per cent, and even then was probably a redistribution of precipitation and not a net increase. The scientific evidence confirming the elimination of hail danger is, as yet, even more undependable.

Professor Mason, whilst exercising a degree of caution appropriate to a leading authority, does not regard the matter as ended. Two of his conclusions are worth quoting to illustrate this.

'Although it is unfortunate that greatly exaggerated claims were made for the results achieved by the early cloud-seeding operators, current claims are much more modest, and the difficulties of executing and evaluating such operations are now much more clearly recognized.'

'It is very doubtful whether man will ever be able to completely control the weather, but it is quite possible that he may have some success on a modest scale, and even this could be of great economic significance.'

This is a book well worth reading, especially by those who hold strong views on the subject.

L.P.S.

Old Farm Tractors. PHILIP WRIGHT. A. and C. Black. 25*s*.

It can be said that this book has been written just in time, because the material it describes is so rapidly disappearing. In the first forty years or so of the present century, many quite different models of tractors were made in small numbers and then replaced by new designs. The few examples left are rapidly rusting away. Until the '30s the making of agricultural tractors was rarely a profitable business, and many firms finished their careers in financial trouble: when this happens to a company nobody has much heart to preserve even the advertising literature or the working drawings. It is quite remarkable how the author has tracked down so many examples of actual tractors, so many makers' catalogues, descriptions of tractor trials and tests, and records of private owners' experiences.

Since the development of modern arable farming is nearly synonymous with the development of the farm tractor, Philip Wright has done a great service to history, and has paid a tribute to the men who gave the world such a fruitful series of ideas and inventions. What the book makes clear is that the revolution in methods of producing tractors has been as great as the revolution in design. The old designers were individual 'characters', and some of them seemed to have combined in themselves the function of the design and prototype departments of our present tractor factories.

For example, Mr. Wright has been in communication with the two Crawley brothers, and has obtained some fascinating personal details of these men who designed the Agrimotor, which used methods of weight-distribution that have since become almost textbook principles. It might have been thought that the Agrimotor could have been produced only by people with long experience, but we learn that one of the two brothers built an experimental model when he was 14 years old and had just left school.

Earlier than the Crawleys, indeed before the turn of the century, Dan Albone had done the preliminary designs for his Ivel tractor. Apparently, in 1906, he was demonstrating harvesting at night with his tractor pulling two binders and cutting 17 acres in six hours. Albone is described as a genius, and no one who understands the complexities and difficulties of field traction will think the description unjustified.

The book has forty-eight photographs and nearly all of them are irreplaceable. The numerous drawings are not of the same high quality and cannot carry the same authenticity, but they do explain some mechanisms such as water-drip cooling, friction change-speed gear, and chain-and-barrel steering, all of which can no longer be found in practice.

H.J.H.

A Window in Suffolk. ALLAN JOBSON. Robert Hale. 18*s*.

I think Allan Jobson can claim some originality in his treatment of yet another book on Suffolk. Unlike the historical novels and the semi-guide books to the County's architecture, Mr. Jobson has confined his story to the countryside of his grandfather, who lived at Westleton. West to Yoxford, north to Blythburgh, and east to the sea at Dunwich is the small area of grandfather's world—a part of Suffolk which must be familiar to most visitors. To those people in particular I would recommend this book as light reading.

Most people have an interest beyond mere sightseeing, and whilst local history of the dim past has its place, the immediate past of a countryside which can be told almost first-hand is a useful record. In this case it is largely the simple rural way of life and its folk lore.

Set in the early days of Queen Victoria, the story concerns a preacher in the local chapel, where fiery words dangled people over the pit every Sunday evening. It was a time when the smell of sheep was considered a safeguard against disease and lives were punctuated by harvests. It was the period, up to the turn of the century, when the tempo of life was still slow, entertainment was of a simple nature, and time-honoured custom still important.

The book contains some delightful Suffolk dialect that adds to the records of word meanings which, unless they are recorded in this way, will be lost to posterity. There will come a time when the translation of 't'one soshen, t'other go yin', is lost.

Telling of the Eel's Foot at Eastbridge, the old windmills which ground out tick-tack, the very intimate records of domestic life and the never-failing thrill of the desperate acts of smugglers, *A Window in Suffolk* is full of stories for easy reading.

P.J.O.T.

ACKNOWLEDGEMENT OF PHOTOGRAPHS

We gratefully acknowledge permission to use the following photographs:

pp. 51, 72 and 73. *Farmers' Weekly*; p. 52. W. Emrys Jones; pp. 56, 58 and 59. G. F. C. Wheeler; pp. 62 and 63. H. J. Ballinger; p. 65. Universal Pictorial Press and Agency Ltd. p. 70. M. Whalley Taylor; p. 74. East Malling Research Station; pp. 78, 79 and 80. National Institute of Agricultural Botany; p. 88. J. Trant.

The sources of the graph on p. 68 were press notices issued by the British Egg Marketing Board and *Poultry and Eggs in Britain 1961-62*. K. E. Hunt and K. R. Clark.

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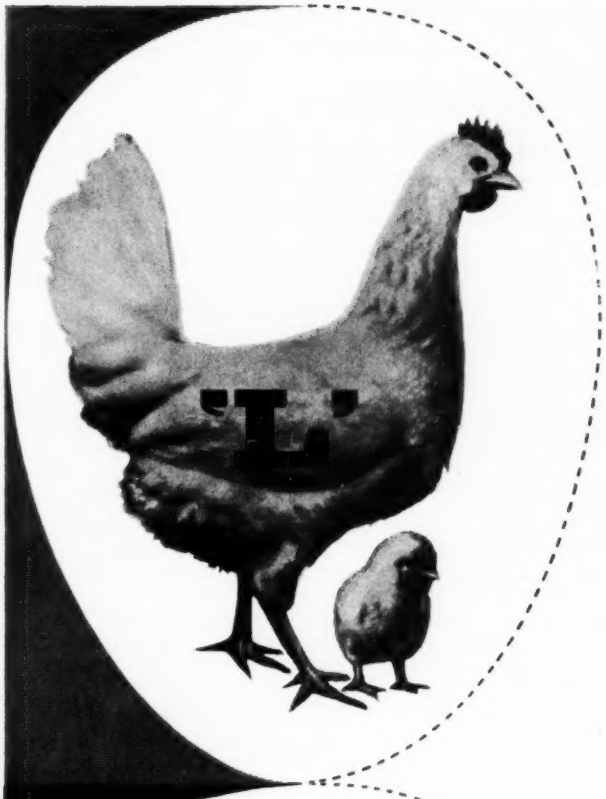
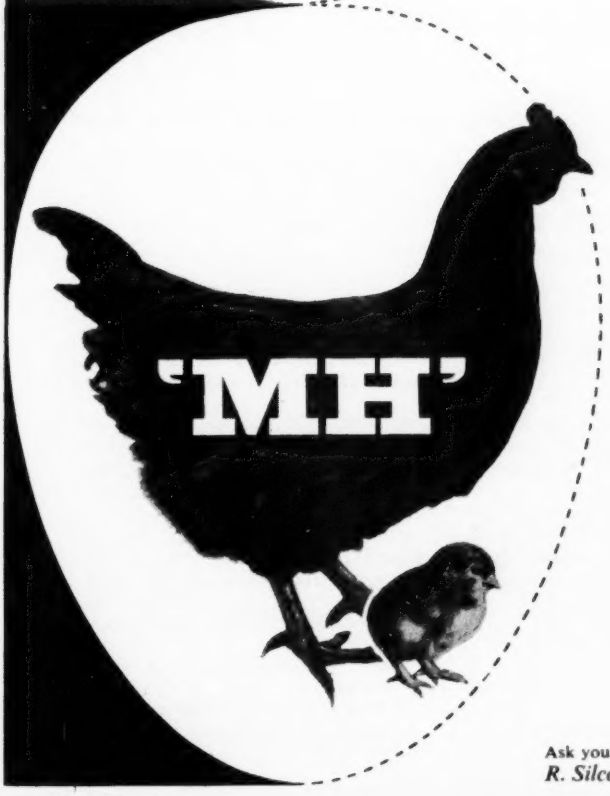
(K95) 72-2-63-2





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LECTURESHIP IN BIOMETRY

Applications are invited for the position of Lecturer in Biometry in the Department of Agriculture. Candidates should possess a degree in Science or Agricultural Science and be qualified in Biometry, agricultural statistics or mathematical statistics. The successful applicant will be required to assist in the teaching of Biometry and in the statistical design and analysis of agricultural and biological experiments within the School of Agriculture. Opportunity will be available for the appointee's own research.

The salary for a Lecturer is within the range £A1,730 × 105—£2,435 per annum, plus cost of living adjustments (at present £A44 p.a.) and will be subject to deductions under the State Superannuation Act. The commencing salary will be fixed according to the qualifications and experience of the successful applicant.

Under the Staff Members' Housing Scheme in cases approved by the University and its Bankers, married men may be assisted by loans to purchase a house.

Further particulars and information as to the method of application may be obtained from the Secretary, Association of Universities of the British Commonwealth (Branch Office), Marlborough House, Pall Mall, London, S.W.1.

Applications close, in Australia and London, on *6th March, 1963.*

UNIVERSITY OF SYDNEY

LECTURESHIP IN PLANT PATHOLOGY

Applications are invited for the position of Lecturer in Plant Pathology in the Department of Agriculture. Preference will be given to applicants with a special knowledge of plant nematology. The successful applicant will be required to conduct laboratory classes and assist generally in teaching Plant Pathology I, to give a specialist course to advanced students and to undertake research and supervision of postgraduate training in his special field.

The salary for a Lecturer is within the range £A1,730 × 105—£2,435 per annum, plus cost of living adjustments (at present £A44 p.a.) and will be subject to deductions under the State Superannuation Act. The commencing salary will be fixed according to qualifications and experience of the successful applicant.

Under the Staff Members' Housing Scheme in cases approved by the University and its Bankers, married men may be assisted by loans to purchase a house.

Further particulars and information as to the method of application should be obtained from the Secretary, Association of Universities of the British Commonwealth (Branch Office), Marlborough House, Pall Mall, London, S.W.1.

Applications close in Australia and London on *6th March, 1963.*

UNIVERSITY OF SYDNEY

SENIOR LECTURESHIP IN AGRICULTURAL CHEMISTRY

Applications are invited for the position of Senior Lecturer in Agricultural Chemistry in the Department of Agriculture. Preference will be given to applicants with training and research experience in biochemistry and enzymology and teaching experience would be an advantage.

The salary for a Senior Lecturer is within the range £A2,550 × 95—£3,000 per annum, plus cost of living adjustments (at present £A44 p.a.) and will be subject to deductions under the State Superannuation Act. The commencing salary will be fixed according to the qualifications and experience of the successful applicant.

Under the Staff Members' Housing Scheme in cases approved by the University and its Bankers, married men may be assisted by loans to purchase a house.

Further particulars and information as to the method of application may be obtained from the Secretary, Association of Universities of the British Commonwealth (Branch Office), Marlborough House, Pall Mall, London, S.W.1.

Applications close in Australia and London on *6th March, 1963.*

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